Journal of the Royal Microscopical Society

CONTAINING ITS TRANSACTIONS AND PROCEEDINGS

AND

A SUMMARY OF CURRENT RESEARCHES RELATING TO

ZOOLOGY AND BOTANY

(principally Invertebrata and Cryptogamia)

MICROSCOPY, &c.

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Minimis partibus, per totum Naturæ campum, certitudo omnis innititur quas qui fugit pariter Naturam fugit.—*Linnæus.*

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1906

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Schizomycetes.

Dec. 19th, 1906

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PROCEEDINGS OF THE SOCIETY.

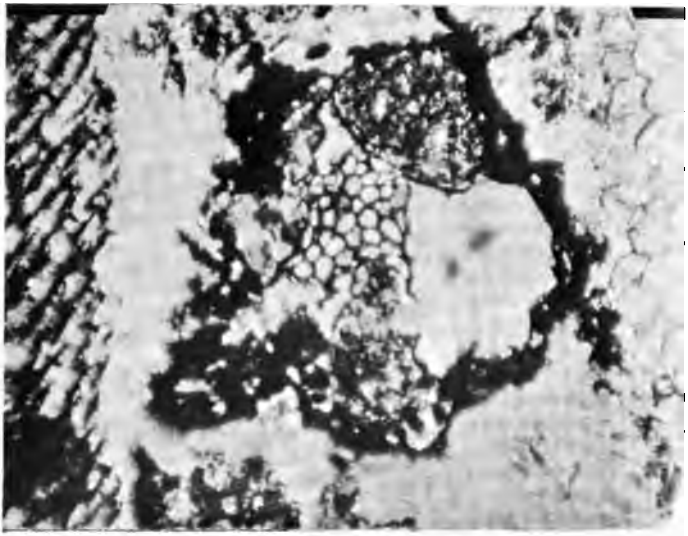


FIG. 1.

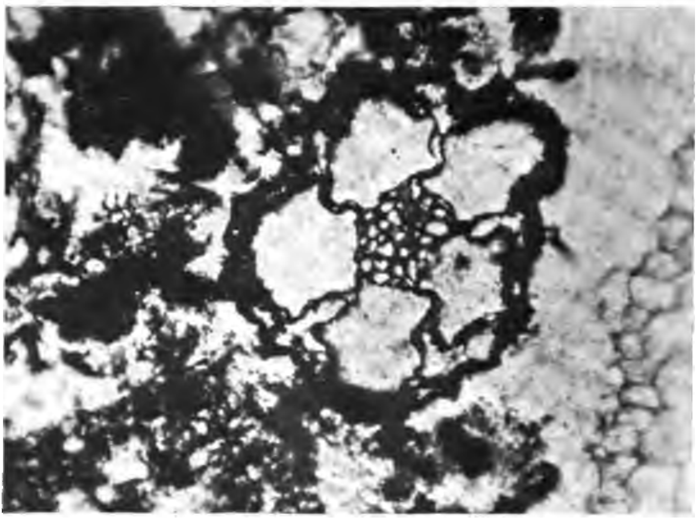


FIG. 2.

JOURNAL

OF THE

ROYAL MICROSCOPICAL SOCIETY.

FEBRUARY, 1906.

TRANSACTIONS OF THE SOCIETY.

I.—*On a "Fern" Synangium from the Lower Coal Measures of Shore, Lancashire.*

By D. M. S. WATSON.

(*Read December* 20, 1905.)

PLATES I. TO III.

THE specimens of a synangium which form the subject of this paper are contained in a slide (No. A89 of my collection) cut by Mr. Lomax, of Bolton, from a coal nodule from the Upper Foot mine, at Shore, which has been opened up by W. H. Sutcliffe, F.G.S. This slide contains in all ten sections of this type of synangium, fortunately fairly well preserved, but all, unfortunately, detached from their support.

General Description.—The synangium consists of from four to seven sporangia, each provided with a separate wall, grouped round a central receptacle, which is hollowed out into a cup above. The whole is surrounded by a continuous integument.

The structure seems to have been fairly substantial, and to have been attached to the organ which bore it by a comparatively small base.

The base apparently received a bundle from the stalk or

EXPLANATION OF PLATE I.

Cyathotrachus altus sp. n.

Fig. 1.—Transverse section, showing columella, sporangia, and spores. × 100.
" 2.—Transverse section, showing the separate wall of each sporangium and columella. × 100.

support, and this in the sterile tissue at the base spread out i cup of short tracheids, which approached the bases of the spora The whole was of small size, measuring only 0·5 mm. in dian and 0·8 mm. in height.

The Receptacle.—The central axis of the synangium an base are composed of normal elongated parenchymatous cells.

In the base of the fructification these cells are short, and cor all round the margin, a cup of short tracheids, which are sp thickened.

These are typical leaf-tracheids, and they are seen to immediately under the bases of the sporangia; they evid served to supply the sporangia during development.

I have been able to find no vascular tissue in the part c receptacle between the sporangia, and I think it very impro that there was any.

The columella was hollowed out into a cup for a distaı about one-third of its length from the top, and into this c seems most likely that dehiscence took place.

The columella in transverse section is seen to fit closely the sporangia, and was provided with ridges to fit in between

The base of the synangium seems to have contracted, altl this might conceivably be due to the obliqueness of the longitı sections. Its base is ragged, and seems to have been torn fr support.

Of the structure of the tissue surrounding the whole synar nothing can be made out, except that it was probably compo two or three layers of elongated cells.

Sporangia and Spores.—The sporangia are all provide separate walls, which, as preserved, appear as one black line.

They are about 0·2 mm. in diameter in a transverse s and are about 0·7 mm. long.

In two specimens they contain spores. These spores ar and have no ornamentation. Their wall is preserved as a membrane. They measure about 15 μ by 12·5 μ.

Similar spores occur scattered in the matrix of the sectic

EXPLANATION OF PLATES II. AND III.

Fig. 3.—Transverse section through the top, showing the cup at the to columella, sporangia, and spores. × 100.
„ 4.—Longitudinal section, slightly oblique, showing cup at sun columella. × 48.
„ 5.—Longitudinal section, showing character of columella. × 48.
„ 6.—Base of Fig. 5, enlarged, showing cup of tracheids in section. (about).
„ 7.—Longitudinal section of base, showing cup of tracheids cut tan so as to give a partial surface view. × 100.

Figs. 1 to 5, and 7, are from photographs by Mr. W. Tams, of Cambri
Fig. 6 is from a camera-lucida drawing by the author.

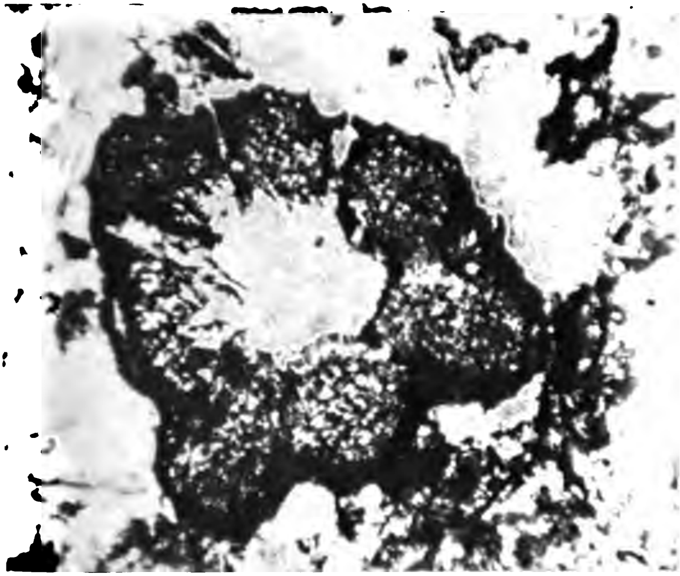


FIG. 3.

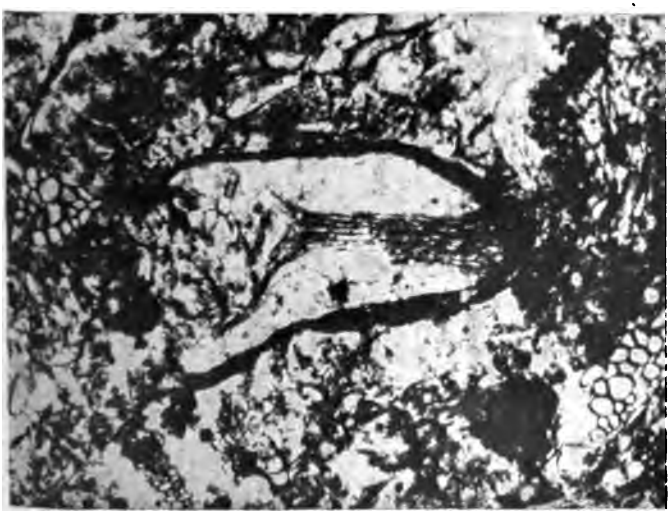


FIG. 5.

[To face p. 2.

FIG. 4.

FIG. 6.

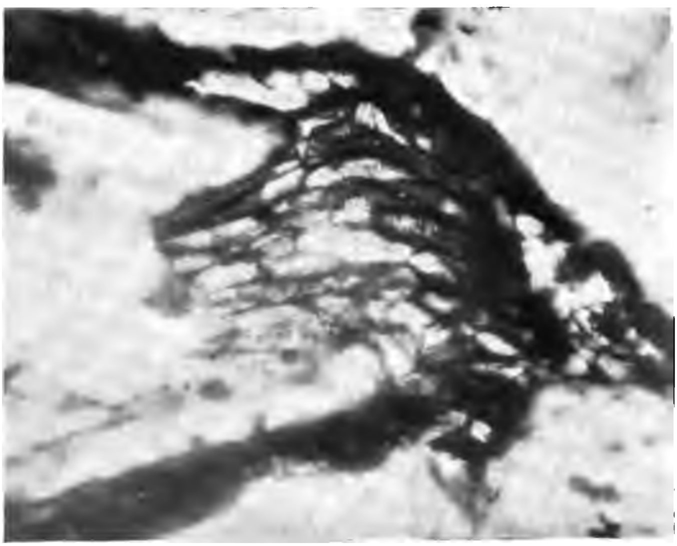


FIG. 7.

General Conclusions.—The preceding description seems to show that the fructification belongs either to the Ferns or to the Cycadofilices, and I think that two years ago no one would have hesitated to say that it belonged to one of the Marattiaceæ.

Now, however, in view of Mr. Kidston's discovery that *Crossotheca*, formerly considered to be Marattiaceous, is really the male fructification of *Lyginodendron*,* whose female fructification is, of course, the seed *Lagenostoma*,† it seems safer to regard it as of uncertain position, although belonging to either the Ferns or the Cycadofilices, and I think most probably to the Ferns.

For this reason I have put the word "fern" in inverted commas in the title.

Association.—The slide contains, amongst other things, *Lyginodendron*, "Cordaites" leaves, and a fern leaflet, which I have not seen elsewhere. This leaflet apparently is a *Pecopteris*; its structure is quite ordinary, but it bears unicellular short pointed hairs on the lower surface. The edges are strongly recurved.

Comparison with other Synangia.—The synangium with which one instinctively compares this, is that known as *Ptychocarpus unitus* Brongn., which occurs as impressions in the Upper Coal Measures of Radstock, in Somersetshire, and with structure preserved in the silicified material from Autun.

It has been well described by Renault.‡

In *Ptychocarpus*, however, the receptacle is not hollowed out into a cup at the top, and contains a vascular bundle rising "jusqu'au sommet du synangium."

There is no cup of tracheids at the base in *Ptychocarpus*, which also has larger spores, measuring 20 μ.

In the recent genus *Kaulfussia* there is a very similar cup of tracheids in the sterile tissue at the base of the synangium. This is figured by Bower.§ In the case of *Kaulfussia* the tracheids seem to be more irregularly placed than in the fossil genus, and do not approach so closely to the bases of the sporangia. The *Kaulfussia* synangium also resembles the fossil in the cup at the top, and in its circular form.

There is, I think, no British synangium described with which this can be compared, and I think that it is advisable to give it a name for convenience of reference. With this in view, I propose that it should be referred to as *Cyathotrachus altus*—in allusion to the cup of tracheids at the base, and to the great relative height of the synangium.

* R. Kidston, paper read Roy. Soc. July 8, 1905, published Nature, July 13, 1905. † Oliver and Scott, "*Lagenostoma Lomaxi*," Phil. Trans., 1904.

‡ Renault, "Bassin houiller et permien d'Autun et d'Epinac," part II. p. 9.

§ Bower, "Studies in the Morphology of the Spore-producing Members of Marattiaceæ," Phil. Trans., series B, 1897.

SUMMARY OF CURRENT RESEARCHES

RELATING TO

ZOOLOGY AND BOTAN

(PRINCIPALLY INVERTEBRATA AND CRYPTOGAMIA),

MICROSCOPY, ETC.*

ZOOLOGY.

VERTEBRATA.

a. Embryology.†

Ovulation in the Rabbit.‡—Walter Heape has studied the o tion and the degeneration of ova in the domestic rabbit. The doe permits coition when undergoing œstrus; if the male be then with the ova are not dehisced, but degenerate in the ovary. Ovul usually occurs about 10 hours after copulation, but does not foll from any cause a sufficient supply of blood to the ovaries is inter with. The author describes the Graafian follicle, the maturation ovulation, the corpus luteum, the degeneration of ripe follicles, an false corpus luteum.

Maturation takes place about 9 hours after copulation; two bodies are rapidly formed after the supply of nutriment to the ov cut off. About 10 hours after copulation the Graafian vesicle rup and the ovum, entirely freed from discus proligerus cells, is sho into the infundibulum, which now closely invests the ovary. The ovum is incapable of assimilating nutriment, unless it be fert Spermatozoa are found at the top of the uterus horn about 2 hours copulation, close to the infundibulum in 4 hours. It is probabl the rupture of the follicle is due to the stimulation of erectile The corpus luteum is formed by the ingrowth of cells surroundin follicle, together with the follicular epithelium; the ingrowth bei one time apparently a forcible rush, before which the loosened e lium is driven.

If a buck is withheld from a doe during several consecutive p

* The Society are not intended to be denoted by the editorial "we," an do not hold themselves responsible for the views of the authors of the noted, nor for any claim to novelty or otherwise made by them. The ob this part of the Journal is to present a summary of the papers *as actual lished*, and to describe and illustrate Instruments, Apparatus, etc., whi either new or have not been previously described in this country.

† This section includes not only papers relating to Embryology prop called, but also those dealing with Evolution, Development, Reproducti allied subjects.

‡ Proc. Roy. Soc., series B, lxxvi. (1905) pp. 260–8.

of oestrus, most, if not all, of the older and many younger follicles then undergo degeneration, and this may result in more or less persistent sterility.

Other causes may induce degeneration of ova, chiefly nutritive causes and competition. Ova may be constitutionally incapable of utilising the nutriment which is supplied, and on which other neighbouring ova flourish.

When young ova degenerate under such conditions, there is a great probability that in these cases the degeneration is due to peculiarities in the constitution of those ova, and that such ova require special facilities for development. They may give rise to "sports." It is reasonable to expect that, given the requisite quality of nutriment, the power of producing variable offspring would be widely extended, and the field for the study of variation correspondingly enlarged.

There is increasing evidence that the ovary is a secreting gland, essential to the normal functions of the rest of the system, and to the normal development of sexual characteristics. There is probably a special generative ferment, or "gonadin," which exercises through blood a profound and far-reaching influence on the organism.

Chromosomes in Relation to Determination of Sex.* — E. B. Wilson has found that the sexes of Hemiptera show constant and characteristic differences in the chromosome groups. The cells of the female may have one more chromosome than those of the male, or one of the male chromosomes may be smaller than the corresponding one in the female. In the first case the spermatozoa are of two classes, one of which contains one more chromosome (the so-called "accessory," or heterotropic chromosome) than the other. In the second case all the spermatozoa contain the same number of chromosomes (half the somatic number), but they are, nevertheless, of two classes, one of which contains a large and one a small "idiochromosome." It may be that fertilisation by spermatozoa with one chromosome wanting, or with a small idiochromosome, results in male offspring.

$$\text{Egg } \frac{n}{2} + \text{spermatozoon } \frac{n}{2} \qquad = n \text{ (female).}$$

$$\text{Egg } \frac{n}{2} + \text{spermatozoon } \frac{n}{2} - 1 = n - 1 \text{ (male).}$$

It may be that the difference between the two types of germ-cell is a matter of metabolism, primarily one of growth.

Resistance to Temperature in Frog's Eggs.†—E. Bataillon finds that the resistance to the influence of temperature increases in the course of embryonic development. It is very marked towards the closure of the blastopore. The unfertilised egg is more resistant than the fertilised egg. The spermatozoa in the seminal vesicles are more resistant than the ova in the lower part of the oviducts. The abnormalities seem to be traceable to a modification of the plasma of the ovum.

* Science, xxii. (1905) pp. 500–2.
† Arch. Zool. Expér., iii. (1905) Notes et Revue, ccxii.–ccxv.

Physical Equilibrium of Amphibian Ova during Maturati
E. Bataillon has experimented with eggs of frogs and toads, whicl believes, exhibit variations in osmotic pressure and turgescence in course of their maturation.

Experiments on Artificial Parthenogenesis in Vertebrat
E. Bataillon subjected the eggs of frog and lamprey to salt solu and sugar solutions. The eggs of the frog formed, at the most, in fect blastulæ; those of the lamprey formed complete blastulæ. mitoses were mostly irregular, but some quite normal nuclear fi occurred.

Development of Chromosomes in Teleostei.‡—J. Maréchal studied this subject in the ovary of *Trigla hirundo* and *Gaster aculeatus*. Briefly reviewed, the main facts made out appear t (1) The formation of yolk, or the trophic alterations of the gr protoplasm, are temporarily related to the beginning of a finer dis tion of the chromosomes. In general, as the protoplasm be darker and more stainable, the chromosomes begin to appear "s Soon, also, several chromatic nucleoli and many chromatin gra lying chiefly on the nuclear membrane, appear. (2) In synapsi spireme phases no achromatic reticulum is to be seen betwee chromatic loops. When the chromosomes already show a spiny a ance, a few delicate threads sparingly scattered stand out between these gradually multiply in order to form a ground reticulum, wh in no way achromatic. (3) Most of the loops appear as in Selac paired or forked. This is not so clear in *Gasterosteus* as in The paper contains a note on some of the stages of the ovarian e *Amphioxus* and in *Ciona intestinalis*.

Ovarian Sac in Bony Fishes.§—B. Haller has studied v types of the ovary in Teleosts, and finds four conditions repres phylogenetic stages. Amongst the Salmonidæ, in *Argentin Mallotus* occurs the most primitive state, where the ovary, pro into the cœlome, is band-shaped, attached by a dorsal mesentery the formation of a lateral furrow in this band; in others (*Sa* better passage for the eggs to the exterior is secured. This co leads over to that where the furrow is closed and each of t ovaries forms a sac. The attachment of the right side of this the body-wall yields a fourth modification, seen in Cyprinoids.

Genital Glands and their Secretions.‖—G. Loisel gives a review of our knowledge of this subject, and brings forward so facts. As derived from the germinal epithelium he quotes ex pigment, the glandular tissue covering the cœlome, a portion supra-renal, fatty bodies, Bidder's organ, lymphoid organs, an haps the Wolffian bodies. The genital glands are the sisters

* Arch. Zool. Expér., iii. (1905) Notes et Revue, ccxii.–ccxv.
† Arch. Entwick., xviii. (1904) pp, 1–56 (4 pls., 12 figs.).
‡ Anat. Anzeig., xxvi. (1905) pp. 641–52.
§ Op. cit., xxvii. (1905) pp. 225–38.
‖ Journ. de l'Anat. et Phys., xl. (1904) pp. 536–62.

true glandular organs. From the beginning of their existence, even before sexual differentiation, they elaborate chemical secretions with the same microchemical characters as the supra-renals and Wolffian bodies. In adult life they become definitely glandular. The internal secretion of the ovary, the cells of the ovary and of the corpus luteum, are described in the paper.

Interstitial Testicular Gland of Horse.*—P. Bouin and P. Ancel have made a careful study of the minute structure of the interstitial glands in the testis of the horse. The matter is somewhat complicated, for there appear to be three successive and distinct interstitial glands.

1. There is a fœtal interstitial gland, strongly developed, but disappearing towards the end of gestation.

2. There is an interstitial gland during the juvenile immature life, but it is slightly developed, and is composed of xanthochrome cells.

3. There is an adult interstitial gland, whose presence coincides with the period of spermatogenesis.

Accessory Sex Glands in Insectivora and Rodents.†—S. Grosz finds in these a variety of forms, both as regards the morphological relation of their excurrent ducts to the urogenital tract, and the histology of the secreting region. Individual forms show remarkable differences in the development of those glands which do not serve the sexual act directly, but which probably function as a means of attraction between the sexes. Such glands are perineal, inguinal, anal, and perhaps also preputial.

Regeneration in Testes.‡—M. Nussbaum discusses the various ways in which reproductive organs form new germ-cells after liberating what they have produced. In the testicular canals of Teleosts, Reptiles, Birds, and Mammals, it was shown by von la Valette St. George that spermatogonia remain inactive until the next sexual period, when they begin again to divide. In Elasmobranchs, it was shown by Semper that quite new ampullæ are formed from a special region of the gonad (*Vorkeimfalte*) after the previously active ampullæ have been exhausted. Nussbaum finds that Anura illustrate the first mode of regeneration; there are resting spermatogonia. But in Urodela (*Salamandra maculata* and *Triton cristatus*) the old ampullæ and most of the testis undergo degeneration, and there is a new formation from the oval apex of the testes which corresponds to the *Vorkeimfalte* of Elasmobranchs.

Formation of Eye Vesicle in Vertebrates.§—A. Froriep describes certain peculiarities of growth in the eye vesicle of Selachians, Reptiles, Birds, and Mammals, showing that it does not arise by the invagination of a previously formed hollow ball. It never has a symmetrical ball-like form; its development into the double-walled eye-cup is by a gradual change from its original formation as a lateral outgrowth of the brain tube.

* Arch. Zool. Expér., xxxiii. (1905) pp. 391–433 (3 pls.).
† Arch. Mikr. Anat., lxvi. (1905) pp. 567–608 (1 pl.).
‡ SB. Med. Ges. Bonn, 1905, pp. 18–20.
§ Arch. Mikr. Anat., lxvi. (1905) pp. 1–11 (1 pl.).

arise secondarily, but by means of the maintenance of intercelluk nections subsequent to mitotic nuclear divisions: the morpho continuity is characteristic of the peripheral nervous system. formations, peripherally as centrally, are to be regarded as neur They are the medulla-forming elements. There are no enshe so-called Schwann cells.

Do the elements of the nerve system usually designated as unities (*Nerveneinheiten*), so far as nerve-cell nets exist, stand tinuous connection? This question is answered in the affirmati the author claims in it a key to the understanding of the morp of the nervous system, from Cœlenterates to man. The neuron of to-day is false, and is supported by no observations fre objections. The right understanding of the nervous system, ontogenetic and phylogenetic relations, it is claimed, can be ar only through the view of central and peripheral neuroblasts or of equal value, and which change partly into central and pe ganglionic and nerve-cells and partly to elements which, thro syncitial structures of the peripheral fibre, yield peripheral ner cells.

Optic Cells of Frog's Eye.*—K. C. Schneider has made son discoveries in regard to the optic cells in the retina. He descril cells, and notes that the apparently homogeneous axial substance rod consists of spiral fibrils with abundant branchings and of geneous cementing substance. He also deals with the green which occur along with the violet-red rods and with the cones.

Double and Polymorphic Nuclei in Triton.†—W. Rul describes in the morula of *Triton tæniatus* the occurrence of dou polymorphic or "mehrblasige" nuclei. These last consist of nucleated vesicles which, in most cases, possess a membran form of the nuclei varies according to the number, form, and ment of the vesicles. The whole complex sometimes has a form, in other cases a heaping of the elements yields a nucle mulberry form. In the case of double nuclei the two vesicl almost identical size, but only one nucleolus is present. It is su that the one is a pure descendant of the egg-nucleus and the the sperm-nucleus. The author does not attach any important cance to these unusual phenomena.

Acidophil Goblet-Cells in Torpedo.‡—K. Helly claims tha found in Selachians the equivalent of the Langerhans islets other animals. They are goblet-cells, whose most distinctive c istic is that their contents are not mucus, but coarse, rounde refracting granules with acidophil reaction. They occur in the gut, and pancreatic duct of *Torpedo marmorata*. They appe scattered between the epithelial cells, and a definite arrang limited only to the deeper crypts.

* Arbeit. Zool. Inst. Univ. Wien, xvi. (1905) pp. 87–98 (1 pl.).
† Arch. Mikr. Anat., lxvi. (1905) pp. 485–500 (1 pl.).
‡ Tom. cit., pp. 434–9 (1 pl.).

Mucous Membrane of Human Alimentary Canal.*—J. E. Schmidt finds that the cells of Paneth appear first in the gut of the human fœtus in the seventh month, and in the new-born child have attained their full development. Normally they are found in the whole of the small intestine, frequently in the vermiform appendix; practically absent in the healthy rectum, they occur here pathologically in polypi, and in the border of carcinoma. There is a specific relation to the digestion of vegetable matter. Goblet-cells are developed in the third month; their number increases gradually; towards the end of fœtal life they become so abundant that in the new-born child the whole rectum and vermiform appendix are covered by an almost continuous layer of goblet-cells and mucus; the lower small intestine also shows goblet-cells in abundance. In the gut epithelium of the human fœtus peculiar cell inclusions occur in the middle of pregnancy, which, on further growth, have the form and reactions of meconium corpuscles. These are emptied into the gut, so that in the new-born child there are no epithelial inclusions. The formation of these corpuscles in the gut is contemporaneous with the beginning of swallowing movements and of the taking up of amniotic fluid in the gut canal. In the dog the same process begins only shortly before birth and ends during the first fourteen days of extra-uterine life, so that here the development of the whole series in the gut epithelia can best be followed.

Structure and Development of Integument.†—E. Retterer continues his account of observations on this subject. The present paper deals with the histogenesis of elastic fibrillæ; fundamental substances —e.g. cement, plasma, mucin; covering epithelium and epidermis; the origin of the external tegument, and the union of epidermis and the dermis; closed follicles of the original epithelium. Some of his general conclusions from the whole research may be quoted. The covering epithelium of the external tegument develops both to the outer and inner sides. The cells of the middle and deep layers proliferate to replace those that desquamate, and to produce cellular generations which will be transformed into connective elements. A reticulated tissue is formed whose cellular individualities each contain, besides a nucleus, a cytoplasm differentiated first into laminæ and anastomosed chromatophile filaments, and secondly into a hyaloplasma in the meshes of the chromatophile reticulum. The development of reticulated tissue is the same in the region of the papillæ and of the follicles. After this web is formed, the elements dissociate themselves from the dermis, the fibres become gelatinous, and the cellular remains are transformed into leucocytes.

Structure and Histogenesis of Bone.‡—Ed. Retterer gives an exhaustive account of the minute structure and development of bony tissue, with special reference to Mammals and Teleosts.

Structure of Tooth Canaliculi.§—L. Fleischmann has studied these in man, monkey, and horse. He has made out the following points.

* Arch. Mikr. Anat., lxvi. (1905) pp. 12–40 (1 pl.).
† Journ. l'Anat. et Phys., xl. (1904) pp. 493–535 (2 pls.).
‡ Op. cit., xli. (1905) pp. 561–640 (12 figs.).
§ Arch. Mikr. Anat., lxvi. (1905) pp. 501–24 (1 pl.).

Neumann's sheaths and odontoblast continuations (dental fib two different well characterised formations. Neumann's shea the dentine canaliculi in the uncalcified and calcified zone, and p at their central ends into a lamella, discovered by Kölliker, whic acids and alkalis like the sheaths themselves. The sheaths p considerable power of resisting acids and alkalis, yet they are resist decaying maceration only in the region of the calcifie Dental fibres arise directly from the odontoblasts, and run Neumann's sheaths.

Lymphoid Tissue in Ichthyopsida.*—A. Drzewina conclu observations on this subject. Adenoid tissue in the Ichthyopsid a reticular framework with leucocytes in the meshes. The retic often clearly of a cellular character, and all kinds of white co known in higher Vertebrates occur, though some possess featu usual in leucocytes. There occur series of transition forms lymphocytes and mononuclears. In those Ichthyopsida witho marrow, the same organs generate, indifferently and simulta elements of the lymphogenic and myelogenic series. The adenoi is scattered through a series of organs—kidneys, wall of digesti liver, pancreas, heart, genital glands, etc. It occurs either in s masses or as differentiated organs, comparable in a degree to the or the lymphatic ganglia of the higher Vertebrates.

Nerve Elements in Amnion of Cat.†—M. Wolff describes amnion of cat, sensory bodies which lie a few millimetres apart. bodies are ovoid, tapering at the ends; they are enclosed w sheath in which nuclei may be seen. The nerve entering has no it winds spirally in the bulb-shaped end organ. The coi numerous swellings, band-like flattenings, and anastomose wi other.

c. General.

Plimmer's Bodies and Reproductive Cells.‡—J. Bretland J. E. S. Moore, and C. E. Walker compare these remarkable st in many cancerous growths with certain vesicular structures o regularly in the gametogenic, but not in the ordinary somatic ce in the case of nuclear division, so also as regards cellular in there is a striking parallelism between reproductive cells and canc Both classes of cells are autonomous to a very high degree; both the faculty of continuous or intermittent multiplication, indepe of the tissue requirements of the organism; both exhibit cellu nuclear metamorphoses which not only, *mutatis mutandis*, resem another, but differ materially from those pertaining to the somatic cells.

Adipogenic Function of the Liver.§—C. Deflandre discu relation of this function to sexual life and its mechanism. It ap

* Arch. Zool. Expér., 4 ser., iii. (1905) pp. 145–76, 187–303, 309–38
† Anat. Anzeig., xxvi. (1905) pp. 658–63.
‡ Proc. Roy. Soc., ser. B, lxxvi. (1905) pp. 230–4 (9 figs.).
§ Journ. de l'Anat. et Phys., xli. (1905) pp. 319–52.

be principally related in both sexes to the genital function. Evidence is supplied by a law of seasonal alternation of these functions as illustrated in *Helix* and *Limax*, in *Asterias*, and in Vertebrates at the time of gestation, of suckling, and the beginning of embryonic life. Histological studies reveal the migration of the fat from the hepatic to the genital glands in various molluscs, in *Astacus* and *Carcinus*; and in higher animals the arrangement of the fat at the level of the supra-hepatic centre in the mother, and at the level of the portal vein in the fœtus, indicates the passage of this fat from the liver of the mother to that of the fœtus.

Tympanic Region in Mammals.*—P. N. van Kempen has made an exhaustive study of the structure of the tympanic region in the mammalian skull. He discusses the development of the cavities and bones connected with the region, the associated nerves and blood-vessels, and the various conditions found in the different orders of mammals. Primitively the tympanic was a narrow ring, incomplete above, in an almost horizontal position, with its ventral wall closely apposed to the skull. The evolution from this primitive condition is traced in detail. The author maintains that the entotympanicum is quite peculiar to mammals, without representative in lower Vertebrates, and that the tympanic is derived from a membrane bone of the lower jaw, probably the supra-angular.

Evolution of Tertiary Mammals.†—Ch. Depéret takes a survey of the various Eocene faunas of Tertiary mammals, and seeks to gain some greater clearness as to the actual phylogenetic events by distinguishing such evolution as took place in the area in question from the results of migrations from distant centres of dispersal.

Bronchial Tree in Birds.‡—G. Fischer gives a comparative account of the bronchial tree in birds. A lower ventral and an upper dorsal region, grouped round the main bronchus, are sharply distinguished. The ventral region is very regular, with 8 passages (bronchi) of large calibre. The dorsal region is more irregular and variable, with 6–10 bronchi. The large bronchi tend to spread on the external surface of the lung; the main internal mass is formed from the bronchi fistularii. The pulmonary artery branches for the most part dichotomously, and the stronger vessels extend between the ventral and the dorsal regions. Round the lumen of the individual bronchi fistularii, short compressed bronchioles are radially disposed; they branch dichotomously and form an air-capillary network with numerous canals of equal width. These air-capillaries form a network with the blood-capillaries.

All the air-passages anastomose. There are no blind-sacs or alveoli. There are some interesting adaptive differences between the lungs of aquatic birds and land birds, between good fliers and poor fliers.

Toxicity of Eggs.§—G. Loisel finds that the yolk of the eggs of the fowl, the duck, and the tortoise contains toxic substances which,

* Morphol. Jahrb., xxxiv. (1905) pp. 321–722 (96 figs.).
† Comptes Rendus, cxli. (1905) pp. 702–5.
‡ Zoologica, xix. (1905) pp. 1–45 (5 pls. and 2 figs.).
§ Comptes Rendus, cxli. (1905) pp. 733–4.

when injected into the veins beneath the skin, or in the general of the body, promptly cause the death of the rabbits, etc., wh experimented with. In all cases the phenomena are those ol intoxication of the central nervous system.

Venous System of Chelonia.*—F. A. Stromsten has stud structure and development of the venous system in various Aı turtles. In general the development of the veins of the hepati and renal portal systems is the same in turtles as in lizards and The detailed differences are discussed. Particular attention is the changes which the umbilical veins undergo, and their u relations to the abdominal veins.

Regenerated Tail in Ptychozoon homalocephalum.† — Annandale describes a case where the distal part of the tail ha reproduced. The scales upon it are slightly smaller than those u uninjured portion; the dorsal tubercles are entirely absent; th membrane surrounding it is only about half as wide as is norma asymmetrical, and not divided into lobes or expanded at the tip tail.

Taste Organs in Mouth of Crocodile.‡ —W. Bath describe mucous membrane of the upper œsophageal region in *Cr niloticus*, quite free from papillæ, taste organs resembling t lizards. They have the form of a short stumpy pear, with thei base on the corium. A distinctly differentiated pore is not dev but a shallow depression is present out of which the sens project. In these taste-buds, supporting-cells and rod-cells (*Sti Stiftchenzellen*) are distinguishable. Interiorly to the taste-buds corium is a mass of connective-tissue cells, whose function is p that of protection of the associated nerve-fibres.

Relation of Jaw Muscles to Salivary Glands in Sna P. K. Hager has examined a very large number of snakes, repre 24 different species, and gives a full account of their jaw musc The mechanism of the poison-gland and its evacuation are fully di In the Colubridæ and Vipers emission is effected by the contra the biting muscles. The most important as regards this func the masseter and the ligamentum zygomaticum.

Habits of Sphagnum Frog.—H. W. Fowler has some int notes on *Rana virgatipes* Cope, which lives amongst the sphagnu mouth of Mare Run in New Jersey. The males are in full cr April. When about to utter their call they inflate their vocal till nearly spherical, and then allow the air to escape by jerks at i of a second. Thus five or six raps are produced, and the sound startling because of its suddenness and volume. "The call be siderable resemblance to the noise produced by wood-chopper

* Amer. Journ. Anat., iv. (1905) pp. 453–85 (12 figs.).
† Journ. Asiatic Soc. Bengal, lxxiii. (1905) pp. 12–22.
‡ Zool. Anzeig., xxix. (1905) pp. 352–3.
§ Zool. Jahrb., xxii. (1905) pp. 173–224 (5 pls.).
‖ Proc. Acad. Nat. Sci. Philadelphia, 1905, pp. 662–4 (1 pl.).

trees at a short distance back in the forest, and is different from the cry of any other Batrachian."

Adrenal Tumours in Frog.*—W. M. Smallwood gives an account of the macroscopic appearance and histology of a pair of adrenal tumours in a frog. There was no evidence of the normal adrenal in its usual position. The cells of the tumour were observed to be dividing rapidly, and in nearly every instance by mitosis, but atypically. They were very similar to normal adrenal cells, so that this is probably a case of an adrenal tumour developed from the entire adrenal body. The tumour is almost identical with human adrenal tumours of the papillary type.

Intermaxillary Gland of Toad.†—R. Oeder finds that this gland has a bilateral primordium, and only three main efferent ducts. That of the frog is an unpaired body with 20–25 ducts opening on the roof of the mouth.

Role of Fins in Fishes.‡—A. Dugès has some new and interesting views on the functions of fish fins. His experiments, which were carried out on *Goodea atripinnis*, yielded the following results. The loss of dorsal and anal fins did not affect the swimming capabilities; removal of pectorals and ventrals caused slight disturbance at first, but the fish soon recovered and swam deliberately. Removal of tail fin caused the greatest inconvenience: the fish at first sank to the bottom and hid, rising later. Another example was able to turn, and rise and sink, and swim forward, but less easily than others. It worked the dorsal and anal fins in place of the lost caudal. When all the fins, except the caudal, are removed, the fish can still swim, but has to keep its fin in continual motion, thus causing the whole body to tremble. The author thinks the whole of locomotion is effected by the caudal fin, and that the unpaired ones simply give precision to the general movements. The paired fins have practically no significance in locomotion: the pectorals seem to serve the purpose of producing currents to aid the gills, since they are more active when the fish is at rest than when moving.

Branchial Filter of Fishes.§—Adolf Steuer gives an interesting account of the branchial filter, with especial reference to Adriatic fishes. Unlike fresh-water forms, marine fishes show great variety in their filter apparatus. Neither phylogenetic nor known œcological factors suffice for the interpretation of the great diversity. The role of the filter is mainly to close the first cleft, which is the largest, and thus to prevent the loss of food and the soiling of the gills; but the varied and detailed action and the diversity of structure cannot be briefly summarised. There is a useful summary as to the diet of Adriatic fishes.

Function of Lateral Line Organs in Fishes.‖—G. H. Parker has experimented with various fishes, chiefly with *Fundulus heteroditus*, in order to determine the function of the lateral line. The sensory organs

* Anat. Anzeig., xxvi. (1905) pp. 652–8.
† Zool. Anzeig., xxix. (1905) pp. 538–9.
‡ Bull. Soc. Zool. de France, xxx. (1905) pp. 107–10.
§ Verh. Zool. Bot. Ges. Wien, lv. (1905) pp. 275–99 (25 figs.).
‖ Bull. U.S. Bureau Fisheries, xxiv. (1905) pp. 183–207. See also Zool. Zentralbl. xii. (1905) pp. 480–1.

are stimulated by infrequent oscillations in the water (about six second), and may be of use in orientation. As regards equilibrat they are not of more importance than the skin, and far less impor than eye or ear. The oscillations which affect the lateral line between the pressures and currents, affecting the skin and the r vibrations affecting the ear. The lateral line organs have their or in the skin, and may have given origin indirectly to the ear.

Chemistry of Respiration in Fishes.*—G. van Rynberk give historical summary of the most important researches on the chem of respiration in fishes, and a useful bibliography.

Flounders with Spinulated Scales.†—Jas. Johnstone discusses occurrence of spinulated scales on the head and lateral line of floun (*Pleuronectes flesus*).

East African Fishes.‡—J. Pellegrin gives an account of the f obtained by M. Alluaud. There is a description of a type species new genus, *Astatoreochromis alluaudi*, from Victoria Nyanza. It bel to the family Cichlidæ. There is also a full description of three species, two of *Paratilapia*, and one of *Tilapia*. A remarkable v bility in the Cichlid family in Victoria Nyanza is noted, although not so marked as in Tanganyika. There is, further, not the e ordinary specialisation of the dentition, but most certainly Vic Nyanza is an evolution centre for the group. Species are little 1 and there are numerous transitional forms — e.g. *Astatoreochi alluaudi* forms a link between *Astatotilapia* and *Oreochromis*.

Gullet Teeth of Elasmobranchs.§—J. W. Spengel has exan these in an embryo of *Mustelus lævis*, 15 cm. long. He found that teeth are not all directed backwards, as stated by Imms. Only the d teeth were so directed. Of the ventral, which are situated in the mu membrane over the hyoid bone, only a few of the anteriorly placed are turned backwards; all the others point forwards. No transit or intermediate stages are present, and there is a gap between th types in which the epithelium forms a separating fold.

Vascular System of the Lamprey.‖—G. Favaro has studied va parts of the vascular system in *Petromyzon marinus*, the vasculari of the branchial lamellæ, the segmental arteries and veins of the t and the disposition of the caudal bloodvessels.

Notes on Cape Verde Marine Fauna.¶—Cyril Crossland con the Cape Verde marine fauna with that of East Africa. A few s are common to the two localities, but the two faunas are very di As far as the evidence of the Cape Verde Islands goes, there is no common to tropical seas. The scanty representation of some g (e.g. Corals and Alcyonarians) and practical absence of certain fa

* Atti R. Acad. Lincei, Roma, xiv. (1905) pp. 530–4.
† Trans. Liverpool Biol. Soc., xix. (1905) pp. 301–3 (1 fig.).
‡ Mem. Soc. Zool. France, xvii. (1904) pp. 174–85 (1 pl.).
§ Zool. Anzeig. xxix. (1905) pp. 332–3.
‖ Atti Accad. Sci. Veneto, Trentino-Istriana, ii., n.s., 1905, pp. 9–30 (4 f
¶ Proc. Zool. Soc. London, 1905, pp. 170–86 (6 figs.).

of others (e.g. Chromodoridæ among Nudibranch Molluscs, and Pseudoceridæ among Planarians), may be features indicative of a sub-tropical fauna, or indications of a different balance of life obtaining in the two oceans. Crossland has a good deal to say about the various animals which help to form the organic rocks of the shore.

Tunicata.

Structure of Appendiculariæ.*—W. Salensky gives an account of the structure of *Oikopleura rufescens*, *Fritillaria pellucida*, and *F. borealis*. He discusses in particular the "house," the oikoplasts, the buccal glands, the nervous system and sense-organs, the alimentary tract, the cardiac structures, and the gonads.

INVERTEBRATA.

Mollusca.

α. Cephalopoda.

Retina of Nautilus and other Cephalopods.†—H. Merton finds that the retina of *Nautilus*, studied in spirit specimens, is of a somewhat unusual type. It is possible to distinguish a phæsome, a fibril, and a rod portion in connection with the optic cells. The eye of some of the littoral Annelids comes nearest that of *Nautilus*, which, complicated as it is in its own way, is of a more primitive type than that of the Dibranchiata. In the Dibranchiata it is not possible to distinguish a special nerve fibril as the receptive organ in the optic cell; there does not seem to be a terminal knob in connection with the fibril; the nerve fibre entering proximally into the optic cell can be followed to the level of the rod-socket.

β. Gastropoda.

Protoconch in Gastropods.‡—H. Leighton Kesteven regards the ideal protoconch as including (1) the plug of the primitive shell-gland; (2) a portion formed by the veliger; (3) a portion formed during the nepionic stage, and finally (4) a portion formed during early neanic stages. He calls these four component parts phyloconch, veloconch, nepioconch, and ananeanoconch, and he discusses their varied degrees of representation. The naticoid initial whorl and the systematic value of the protoconch are also discussed.

Genital Organs of Polycera.§—H. Pohl gives an account of the minute structure of the genital system of *Polycera quadrilineata*, together with particulars regarding its general topography. The nidamental gland arises through a special differentiation of a simple "Gangschleife," and is thus not (as was formerly believed) a special subsidiary gland of the oviduct. It is like the albumen gland, only a specialised region of it. That the eggs actually pass through the nidamental gland is certain from the shape of the spawn ribbon, which has the form of the pars constricta. There is a long ductus receptaculo

* Mem. Acad. Imp. Sci. St. Pétersbourg, xv. (1904) pp. 1–106 (12 pls.).
† Zeitschr. wiss. Zool., lxxix. (1905) pp. 325–96 (3 pls. and 2 figs.).
‡ Proc. Linn. Soc. N.S. Wales, xxx. (1905) pp. 325–35 (2 figs.).
§ Zool. Jahrb. Abt. Anat., xxi. (1905) pp. 427–52 (2 pls.).

uterinus which here and in related Doriidæ bears three seminal ve Their exact significance has not been made out.

Genitalia of Lymnea.*—F. C. Baker describes the genital of *Lymnæa stagnalis appressa* Say, and other American forms—9 s and 2 varieties. There are noteworthy differences in the length penis in relation to the penis sac, in the penis retractor muscles, i colour especially of the receptaculum, and so on. The characte greatly in the separation of the species, but do not seem to aid mat in the establishment of higher groups.

δ. Lamellibranchiata.

Parasitism of Anodonta Larvæ.†—V. Faussek gives a full ac in Russian, of the changes which befall the Glochidia of An after they become parasitic on the fins or gills of fishes or Amph Among the hosts infected he deals with *Alburnus lucidus*, *fluviatilis*, *Osmerus eperlanus*, *Carassius auratus*, tadpoles of frog, *i pisciformis*.

Oysters of Senegambia.‡—A. T. de Rochebrune has inves the question of the fossil oysters of Senegal, and concludes th are not Etheridæ, as has been alleged. The Etheridæ have no and cannot live in the Senegal and its affluents below 110 kil from the mouth of the river, on account of the saltness of the The oysters are of Quaternary age like those of Gambia. La *Gryphæa angulata* is simply a deformed individual, and cannot l for the oyster of Portugal. The name *angulata* must give p *G. rostralis* Lamarck.

Ligamentary Structures in Bivalves.§—R. Anthony has f the development of the shell from its beginning to the adult co in *Ætheria caillaudi* Feruss., and has demonstrated the progres pseudo-plicature and the formation of the ligamentary crest follows from it, as well as the consequent modifications of the li The general conclusion is that the development of these struc the Acephalæ is analogous to that in the Ætheriidæ—that, in fa is here an example of convergence.

R. Anthony ‖ has made an elaborate study of those "pleur bivalves, i.e. those whose sagittal plane (bucco-ventral-ano-d parallel to the plane on which they rest. Those whose sagittal perpendicular to the plane on which they rest are called "e The pleurothetic Dimyaria are Dimyidæ, Chamidæ, Myoc Chamostreidæ, Ætheriidæ, Rudistæ, and Chondrodontidæ. E what consequences the pleurothetic position may be said to ha coronal symmetry takes the place of the primary sagittal symme form tends to become rounded; the siphonal and pedal apparatus be reduced.

* Amer. Naturalist, xxxix. (1905) pp. 665–79 (11 figs.).

† Mem. Acad. Imp. Sci. St. Pétersbourg, xiii. (1903, received 1905) 78 pls.).

‡ Mem. Soc. Zool. de France, xvii. (1904) pp. 191–201.

§ Comptes Rendus, cxl. (1905) pp. 948–50.

‖ Ann. Sci. Nat., ser. 9, i. (1905) pp. 165–397 (3 pls., 57 figs.)

Arthropoda.

Muscle-Attachment and Origin in Arthropods.*—E. Smethlage deals with this subject in a number of Insect orders, some Crustaceans, and Arachnoids. He concludes that the muscles are not fixed to the hypodermis, but directly to the chitin of the outer skeleton. Laterally, the plasma envelope surrounding the muscle-cell passes without definite boundary into the plasma of the hypodermis, the basal membrane of the latter passing round and forming the sarcolemma. Cells lying immediately beneath the chitin give rise both to muscle-fibrils and chitin. They may be regarded as epithelio-muscle-cells, since they subserve the functions of both tissues. It is stated that in *Artemia salina* the musculature of the extremities is differentiated from the hypodermis, and is thus ectodermal. Examination of developmental stages did not reveal anything which might be regarded as mesoderm in the sense of a special germinal layer.

a. Insecta.

Poly-embryony in Parasitic Hymenoptera.†—P. Marchal has found more instances of poly-embryony or germinogony. After fertilisation, and before the least hint of the germinal layers, the egg is dissociated into a number (12–100) of germs, which proceed to develop. This "specific poly-embryony" occurs in the Chalcidiidæ in *Ageniaspis fuscicollis* (Dalm.) Thoms. = *Meyrtus fuscicollis* (Dalm.), and in *A. testaceipes*. It also occurs in Proctotrypidæ (*Polygnotus minutus*). Full details are given of the remarkable development. Marchal thinks that in experimental poly-embryony, in accidental or teratological embryony (true twins, double monsters), and in specific poly-embryony, the factors are the same, and that the chief one is a change in osmotic pressure at the beginning of segmentation. It is noteworthy that the individuals which arise from one ovum are of the same sex.

Poly-embryony in a Hymenopterous Parasite.‡—F. Silvestri describes the remarkable peculiarities of development in *Litomastix truncatellus* Dalm., one of the Encyrtidæ, which lays its eggs in those of *Plusia gamma*. The ova may be parthenogenetic, or they may be fertilised. In both cases there are two polar bodies formed, and the first divides into two. The three unite into one, which seems to share in the development. The parthenogenetic ova give rise to males only; the fertilised ova give rise to females only. Two kinds of larvæ—asexual and sexual—are distinguished, and each egg may give rise in two different ways to a number of larvæ of both kinds. We have found it difficult to follow the author's account, but a less condensed memoir is promised. Three points are emphasised—poly-embryony, the peculiar history of the polar bodies, and the dimorphism of the larvæ.

Morphology of the Insect Head.§—S. Bengtsson maintains, with special reference to the larva of *Phalacrocera*, that the insect head has

* Zool. Jahrb. Abt. Anat., xxi. (1905) pp. 495–514 (2 pls.).
† Arch. Zool. Expér., ii. (1904) pp. 257–335 (5 pls.).
‡ Atti R. Accad. Lincei Roma, xiv. (1905) pp. 534–42.
§ Zool. Anzeig., xxix. (1905) pp. 457–76 (5 figs.).

four appendicular segments: (1) the mandibular; (2) the endol (3) the maxillary; and (4) the ectolabial ("labial" of most autho

Structure of the Insect Ovary.*—Heinrich Ritter von Wielov has investigated the structure of the ovary in various types of i The essential constituents are: the terminal filament, the propria, the follicular epithelium, and the germ-cells, and the discusses these in detail. The nutrition of the ova in Ortl (except *Forficula*) and in the flea is either direct through the propria or by help of the follicular epithelium from the blood (pa ovaries). In all other groups there is a differentiation of the ge material into oocytes and nutritive-cells. The nutritive-cel originally germ-cells or their direct derivatives. Follicle-cells become nutritive-cells. The nuclei of the nutritive-cells beha those of most gland-cells.

Bees and Flowers.†—J. Wery has made experiments with from which the corolla was removed and others which were l injured. The position was changed from time to time, and the v the bees were counted. In June the uninjured flowers were vis 107 insects, of which 72 were bees; the flowers without corolla, l conspicuous, were visited by 79 insects, of which 28 were bees. experiments had similar results. A glass vessel with honey v unvisited; artificial flowers proved as attractive as the real The author concludes that the form and colour of the flow indisputably more potent in attracting bees than the pollen, ne fragrance.

Wax-Glands of Bees.‡—L. Dreyling points out that in *Bom* wax-glands are formed dorsally and ventrally, and that nearly th of the hypodermis of the segments shares in the secretion. In *A* and *Trigona* the secretion is restricted to the dorsal surface, in h to the ventral surface. In various respects, as regards the wax the humble-bees are intermediate between the solitary and th Apidæ.

Wax-forming Organs in Social Bees.§—L. Dreyling give account of the regions bearing these organs in the honey-bee Meliponidæ. In the workers of the honey-bee wax is secr specially developed skin-glands on the last four ventral plate abdomen. These glands are recognisable even in the pupa stage fully developed bee, after their maximum of development is they gradually degenerate with increasing age. The Meliponi the wax-secreting glands on the dorsal side of the abdomen, c they are similar to those of the honey-bee. The Trigonæ secrete wax on the dorsal side of the abdomen in segments 2 the same segments wax occurs in the humble-bees also, where, wax-glands are developed ventrally as well as dorsally.

* Arbeit. Zool. Inst. Univ. Wien, xvi. (1905) pp. 1–62 (3 pls.).
† Bull. Acad. Roy. Belgique (1904) 53 pp. See also Biol. Centralbl., pp. 270-1.
‡ Zool. Anzeig., xxix. (1905) pp. 563–73 (6 figs.).
§ Zool. Jahrb., xxii. (1905) pp. 289–330 (2 pls.).

Seminal Vesicle-duct of Queen Bee.*—E. Bresslau finds that the so-called "circular muscle" or sphincter of the seminal vesicle duct does not exist. What is actually present is a complicated pump-like apparatus, whose main parts consist of a parallel pair of longitudinal muscles and a dorsally-placed, semicircular, more weakly developed, muscular band.

Coloration in Polistes.†—W. E. Enteman gives a general account of this genus of wasps, and discusses variations of colour-pattern and its development, the physical and chemical character of the pigment, the geographical distribution of the types of colour-pattern, and several other factors bearing on evolution theories.

Experimental Alteration of the Colours of Lepidoptera.‡—Countess M. von Linden summarises past experiments, and gives an account of some which she has made bearing on the changes of coloration and marking, which can be induced by abnormal conditions during the pupa period. We notice some conclusions. The formation of dark pigments in the insect body is ultimately due to reduced oxidation in the plasma, to an imperfect metabolism in the body of the pupa. Abnormal cold and heat affect the normal irritability of the plasma, acting like narcotics. The new colour-characters of the butterfly may be so deeply rooted that they are repeated in the offspring when these are reared in normal conditions. The offspring of modified specimens of *Vanessa ichnusoides* bear the marks of disturbed metabolism and are themselves modified.

Variability of Cobas Myrmidone.§—A. Pieszczek gives an account, with an exceedingly fine coloured plate, of the variations of this butterfly.

Colouring Matter in Vanessa.‖—Countess M. von Linden has studied this subject, and finds that the red pigment contains an albuminoid body, a combination of a parent substance of the albuminoses and a colouring matter having the property of bile pigment. It recalls hæmoglobin; it changes colour with the degree of oxidation. It is present in the epiderm of the caterpillar, chrysalis, and butterfly, and also in the cells of the blastoderm. The different colours in the butterfly's wing correspond to different degrees of oxidation. The change of colour which is produced in the epidermis of the caterpillar and the chrysalis during development and the evolution of colour is the result of reduction and of oxidation. The pigment of *Vanessa* has a respiratory significance, forming with oxygen less stable combinations. The red substance arises from chlorophyll. This transformation may happen in the plant-cells, or in the intestinal epithelium of the caterpillar, or in its skin, or in that of the chrysalis. Chlorophyllane is an intermediate product of the transformation.

Digestion in Caterpillars.¶—L. Sitowski has studied the process of digestion in some moth larvæ, e.g. of *Tinea* and *Tineola*, which feed on

* Zool. Anzeig., xxix. (1905) pp. 299–323.
† Publications Carnegie Inst. Washington (1904) 88 pp. (6 pls.).
‡ SB. Med. Ges. Bonn, 1905, Zweite Hälfte, pp. 25–33.
§ Verh. Zool. Bot. Ges. Wien, lv. (1905) pp. 401–23 (1 pl.).
‖ Ann. Sci. Nat., xx. (1904) pp. 295–363 (3 pls.).
¶ Bull. Internat. Acad. Sci. Cracovie, 1905, pp. 534–48 (1 pl.).

fur and the like. The food consists mostly of keratin, with very proteid, carbohydrate, or fat; yet the larvæ thrive well. He dis the reactions in different parts of the alimentary tract, the fer which digest the keratin, the uric acid in the hind-gut, and s Among the results of feeding the larvæ with various materials demonstration of the interesting fact that some substances like may pass into the eggs and affect the offspring.

Parthenogenesis in a Beetle.*—A. A. Ssilantjew has been a convince himself that *Otiorhynchus turca* may be parthenoge A female, certainly not fertilised, laid hundreds of eggs, and the were reared till they were ¼–⅓ of their normal size. Over a tho specimens were collected, but there was no male.

Unfertilised Ova of Tenebrio Molitor.†—Th. Saling notes t natural conditions the unfertilised eggs of *Tenebrio molitor* do not de but undergo a peculiar degeneration which is described. He think artificial conditions will be discovered in which the unfertilised e develop as in *Bombyx mori*.

Blind Bombardier-Beetle.‡—E. Reitter describes *Brachynillus dorffi*, g. et sp. n., a blind Carabid from German East Africa. adapted in an interesting way to life in caves. It has lost its ey wings are atrophied, the pigmentation is reduced to an almost chrome brown-yellow, and there is notable elongation of the anteri of the body, of the antennæ, and legs.

Revision of American Pæderini.§—Thos. L. Casey has tackl arduous task of revising the great multitude of species included i tribe of Staphylinid beetles. He discusses 89 genera, of which 64 within the limits of the United States.

Treatise on Culicidæ.‖—R. Blanchard gives an account structure, life-history, and habits of Culicidæ, dealing with ov species of *Culex, Psorophora, Anopheles*, etc. Special attention h paid to the medical importance of mosquitos.

Studies on Culicidæ.¶—E. P. Felt, in his report as Entomologist, includes a key for the identification of mosquito descriptions of new or insufficiently characterised species, and so cussion of the structure and phylogeny of the family.

Structure of the Tsetse-Fly.**—E. A. Minchin gives a fine of the structure of *Glossina palpalis*, and especially of the d tract, obviously of importance to those who are studying the ev of the trypanosomes of sleeping sickness, and other tsetse-fly d within the body of their invertebrate host. Figures are given

* Zool. Anzeig., xxix. (1905) pp. 583–6 (2 figs.).
† Tom. cit., pp. 587–90 (2 figs.).
‡ Wiener Entom. Zeit., 1904, pp. 178–9.
§ Trans. Acad. Sci. St. Louis, xv. (1905) pp. 1–248.
‖ Les Moustiques, histoire naturelle et médicale. Paris, 1905, 673 pp.,
¶ New York State Education Department, 20th Report of the Sta mologist, 1905, Bull. 97 (Entomology, 24) pp. 442–97 (19 pls. and 21 figs.).
** Proc. Roy. Soc., series B, lxxvi. (1905) pp. 531–47 (6 figs.).

nervous system, digestive tract, genitalia, and other structures, and a full description of all but the muscular and tracheal systems.

Genital Appendages of the Tsetse-Fly.*—W. Wesché describes the relatively large and very complex male genital appendages of *Glossina palpalis* Des., the host of the germ of sleeping sickness. He compares them carefully with those in other Diptera, e.g. *Scatophaga lutaria*.

Dipterous Larvæ from Deep Water in Lakes.†—J. Schneider discusses the fauna of deep water in Lake Bieler, with especial reference to the Dipterous larvæ. He deals with the larvæ of *Tampus*, *Chironomus*, *Simulia*, and *Corethra*, and refers also to other constituents of the fauna, such as *Candona studeri*, *Pisidium*, *Limnodrilus*, and the like.

Trichoptera Pupæ.‡—A. Thienemann gives an account of the morphological features and their significance in pupal life, the changes taking place during the same, and the transformation to the imaginal state. Only one or two points can be quoted. Histolysis and histogenesis are naturally effected, while at the same time there is no such thing as outer rest. Constant swinging of the abdominal segments takes place, this being necessary for breathing purposes. The result is the renewal of the water with its dissolved oxygen in the pupal case. Various structural adaptations in the abdomen are described, such as the "lateral line" and the cleansing apparatus which averts the danger of impure particles entering during these movements. Some have a pupa case which is closed on all sides, and gas exchanges are effected by osmosis through the walls. In these cases the vitality is lowered; the temperature of the water (mountain streams) keeps down the exchanges of material, including oxygen.

Scale-insect of Rose.§—T. D. A. Cockerell describes from twigs of the wild rose (*Rosa*) at Coulter, Colorado, a new Coccid, *Pulvinaria coulteri* sp. n. In the size of its antennæ on the one hand, and size of scale and ovisac on the other, it resembles *P. aurantii* and *P. amygdali*. From this last, however, it differs in the character of the skin, the second antennary joint, anterior femur, and anterior tarsus.

Two New Cynipid Galls.‖—E. Graeffe found near Trieste a gall which J. J. Kieffer has diagnosed as new, namely, *Cynips tergestensis* on *Quercus robur*. Graeffe describes another new form from Greece, viz. *C. moreæ* on *Quercus cerris*.

Monograph on Aphis ribis.¶—J. H. L. Flögel gives a full account of this currant aphis, taking account of twenty-one different stages from the winter-egg onwards, and discussing not only its structure and life-history, but its habits and economic importance as well. His

* Journ. Quekett Micr. Club, 1905, pp. 283–8 (1 pl. and 1 fig.).
† MT. Nat. Ges. Bern, Nos. 1565–90 (1905) pp. 165–95 (1 pl.).
‡ Zool. Jahrb. Abt. Syst., xxii. (1905) pp. 489–574 (5 pls.).
§ Zool. Anzeig., xxix. (1905) pp. 514–15.
‖ Verh. Zool. Bot. Ges. Wien, lv. (1905) pp. 370–3 (2 figs.).
¶ Zeitschr. wiss. Insect., i. (n.s.) 1905, pp. 49–63, 97–106, 145–55, 209–15, 233–7 (27 figs.).

monograph is a "gekrönte Preisschrift" of the German Entomolo[g] Society.

Supposed Numerical Preponderance of Males in Odonata[*] R. J. Tillyard maintains that the prevailing view that there are more males than females among Odonata is fallacious. The male[s] more conspicuous, more brilliant, more frequently on the wing, [m] diurnal, and therefore more likely to be collected. The females c[...] live apart from the males, and live a more retired life. By rea[ring] nymphs of *Lestes leda*, a common Agrionid around Sydney, the au[thor] found that the ratio of the sexes was one of equality.

Dimorphism in Female of Ischnura heterosticta.†—R. J. Till[yard] describes the two forms of the female in this dragon-fly. The g[enus] *Ischnura* consists of very fragile and defenceless forms, with lin[...] powers of flight, and it seems probable that the second form of fe[male] which is very like the male, may in some manner help to pre[vent] extermination by deceiving enemies. The case is a very interesting

Phosphorescent Collembola.‡—F. Ludwig calls attention to frequent occurrence of *Sminthurus bicinctus* and *Entomobrya* on *I[...] borus fœtidus* and other plants. He suggests that the luminosit[y] some flowers and leaves may be due to Collembola, in some of w[...] e.g., *Aphorura fimetaria*, *A. armata*, and *Neanura museorum*, [...] phorescence has been proved.

γ. Myriopoda.

Variation in Scutigera.§—K. W. Verhoeff gives numerous d[...] regarding the variability of *Thereuonema* species. He found this marked in forms from China and Japan, where it occurs eve[...] oppositely placed parts in an individual. It is greater in the segm[ents] of the antennæ than in those of the tarsus. A number of cas[es] discontinuous variation in the tarsal elements of various *Scu[...]* genera are described.

δ. Arachnida.

New Excretory Organ in Hydrachnids.‖—Karel Thon describ[es] *Limnochares* and *Eulais* a coxal excretory organ in the region o[f] second coxa. A number of wedge-like bipolar cells (schedocytes) a spherical group round a small lumen with a simple efferent The formation of the intracellular excretory granules is describ[ed] detail. In *Eulais* the organs are most active in the nymph period degenerate in the adult when the proctodæal excretory organs beg[in] function. In *Limnochares* the coxal organs continue to fun[ction] actively in adult life.

Arachnological Notes.¶—F. Silvestri describes the young f[...] and the male of that interesting primitive type, *Kœnenia mirabilis*

* Proc. Linn. Soc. N.S. Wales, xxx. (1905) pp. 344–9.
† Tom. cit., pp. 302–6.
‡ Prometheus, vii. (1904) pp. 103–7. See also Centralbl. Bakt. Parasit (1905) pp. 659–60.
§ Zool. Anzeig., xxix. (1905) pp. 353–71.
‖ Zeitschr. wiss. Zool., lxxix. (1905) pp. 465–95 (1 pl.).
¶ Redia, ii. (1905) pp. 239–61 (4 pls.).

deals with the three Italian species of *Kœnenia*. He also describes *Acropsopilio chilensis* g. et sp. n., referred to a position among those Opilionidæ palpatores which have some characters of the Eupnoi and many characters of the Dyspnoi. Another new form is *Opilioacarus platensis* from South America, a mite belonging to the sub-order Notostigmata.

New Spider.*—Frank P. Smith describes *Anglia hancockii* g. et sp. n. from Yarmouth. It has affinities with the Linyphiinæ and the Erigoninæ, but the structure of the palpus and palpar organs leads the author to refer it to the latter sub-family, of which it appears to be an early type.

Structure of Hydrachnid Eyes.†—P. Lang has investigated these in *Diplodontus despiciens*, *Curviceps carneus*, and other species of different genera. Hydrachnid eyes are single layered, not inverted ocelli, without vitreous body or preretinal membrane. The retina cells are in the main arranged in groups of two. Each cell differentiates a rhabdome element, so that the rhabdomes are bipartite. Both the anterior ocelli are movable, except in those cases where movement is prevented by the enveloping chitinous capsule. In double eyes the posterior smaller visual body moves passively with the others. The movement is effected by a muscle attached to a horn-shaped lens continuation which is closely fastened to the cuticula dorsally. No accommodation is brought about by the movement, but only a change of direction of the visual axis, so that new objects are projected upon the retina. Some comparisons are made with the eyes of other Arthropods.

ε. Crustacea.

Life-History of the Lobster.‡—H. Chas. Williamson describes the larval stages of *Homarus vulgaris*, with finely illustrated details as to the appendages and branchiæ. Some of the common variations of the megalops are noted. The processes of moulting are discussed at length, and there are many interesting notes on behaviour, spawning, hatching, as well as statistics regarding rate of growth.

The Genus Peneus.§—A. Alcock gives a revision of this genus. All the sections—genera or sub-genera—into which the old Fabrician genus has gradually become split are tabulated and briefly defined, and an attempt is made to sift all the species that have been described under the name *Peneus* and to distribute them to their proper sections. The paper contains further the diagnoses of nine new forms.

Sense-Organ in a Schizopod.‖—R. Dohrn describes on the eye-stalks of the Schizopod *Eucopia* a short funnel-shaped prolongation, situated on the side turned towards the median plane of the animal. It lies projecting over the eye. At the base there is a cell complex, bulb-shaped, and immediately below this an oval heap of cells about the same

* Journ. Quekett Micr. Club, 1905, pp. 247–50 (1 pl.).
† Zool. Jahrb. Abt. Anat., 1905, pp. 453–94 (2 pls.).
‡ Fishery Board for Scotland, 23rd Ann. Rep., part iii. (1905) pp. 65–107 (4 pls.).
§ Ann. Mag. Nat. Hist., xcv. (1905) pp. 508–32.
‖ Zool. Anzeig., xxix. (1905) pp. 347–52.

size from which a cord passes towards the ganglion complex, fillir the inner part of the greater portion of the eye-stalk. Full deta the histology of this organ, which is probably a skin sense-organ given.

Species of Acetes.*—Kamakichi Kishinouye describes a Jap shrimp which seems to be a new species of the genus *Acetes*, and noteworthy peculiarity in the structure of the flagella of the s antennæ. The flagellum is about twice the total length of the ar and consists of a proximal and a distal portion. The latter is the l and the two parts are connected by a series of short and somewha matic joints, about ten in number and bent somewhat like the let The distal portion proceeds horizontally backwards, making ne right angle with the proximal portion. The proximal portion is stiff, and its joints bear very short hairs on the inner margin. outer margin is free of hairs, except on eight distal joints, e which shows a pair of very long ciliated hairs. Each joint of the portion has a pair of long ciliated hairs on the outer margin, wh inner margin is provided with short hairs in some joints. Some in the proximal as well as the distal portion of the flagellum ha distal margin serrated. These serrated joints are distributed at ir intervals.

Caprellid in Lake Geneva.†—L. Blanc found in a plankt from a depth of 40 metres in Lake Geneva the female of a Ca that is to say a distinctively marine form. It occurred alon *Bythotrephes*, *Bosmina*, and *Dinobryon*. It belongs to the genu *lirius*, and is nearest *P. minutus* P. Mayer. Can it have been fort introduced from the sea by a migratory bird, or is it a true in the lake?

Subterranean Isopods.‡—A. Dollfus and A. Viré give an of some Isopods of subterranean regions in Europe. They appe to a considerable extent remnants of Tertiary fauna. Of the midæ there are four species belonging to three genera; the Cirolanidæ is also represented. The authors have given specia tion to the sensory apparatus and brain. They find that the los sense of sight is compensated by hypertrophy of the tactile, a and olfactory organs. Motor cells and fibres are so multiplie brain that the whole surface and volume are enormously augme

Galvanotaxis of Entomostraca.§—J. Paulsen has experimen Cyclopidæ, and found that only by employing a high tension could a galvanotaxis be demonstrated. They were found to tively galvanotactic.

Revision of certain British Copepoda.‖—T. Scott has through the study of much fresh material to make the following

* Annot. Zool. Japon, v. (1905) pp. 163–7 (2 figs.).
† C.R. VI. Congr. Internat. Zool. Berne, 1905, pp. 425–9 (4 figs.). Zool. Zentralbl., xii. (1905) p. 748.
‡ Ann. Sci. Nat., xx. (1904) pp. 365–413 (2 pls.).
§ Zool. Anzeig., xxix. (1903) pp. 238–44.
‖ Ann. Mag. Nat. Hist., xcv. (1905) pp. 567–71.

of nomenclature. Full diagnoses of the types referred to are given. *Delavalia mimica* T. Scott becomes *Beatricella mimica* g. n. *Delavalia robertsoni* var. T. Scott, 1899, becomes *D. normani* T. Scott, n. n. *Jonesiella hyænæ* T. Scott, 1893, becomes *Thompsonula hyænæ* J. C. Thompson.

Seasonal Dimorphism in Daphnids.*—W. Ostwald has shown in detail that structural changes as well as functional changes in Daphnids are correlated with changes of temperature. Increased temperature almost always increases the fertility, the rate of reaching reproductive maturity, and so on, but it also affects the form of the head, especially at a critical period at the beginning of the second stage in the development.

Ephippium of Daphnia hyalina.†—Adolf Zwack gives a detailed account of the fully-formed ephippium, its outer wall of elongated hexagonal prisms, its inner lining which consists of a simple lamella with a peculiar structure. He discusses the development of the ephippium, the sudden filling with air, and the final separation.

Annulata.

Spermatogenesis of Earthworm.‡—E. Bugnion and N. Popoff describe the spermatogenesis of *Lumbricus agricola*. There are four phases: (1) A phase of proliferation, starting with the primitive germ-cell, leads to the formation of the follicle. It occurs in the testes; it gives rise to syncytial groups of 2, 4, 8, 16 elements, and then to colonies of follicles of 32, 64, 128, or more cells, united by short stalks directed towards the centre. (2) A phase of dissociation involves a division of the follicle into groups of spermatogonia, pyriform cells with delicate stalks directed towards the centre. (3) A second phase of proliferation (segmentation) may raise the number in a stalked group from 2, 4, or 8, to 16 or 32. (4) A final phase of multiplication transforms a group of 32 into a morula of 64 spermatocytes round a central blastophore, and finally leads to the finished morula which has normally 128 spermatids.

Indian Species of Chætogaster.§—Nelson Annandale describes *Chætogaster bengalensis* sp. n., the first recorded Asiatic species. The prostomium forms a large sub-circular sucker; there is a smaller sucker at the posterior end; the œsophagus is longer than the pharynx; there is a sense-organ (otocyst ?) in the brain; in the first few segments the two ventral nerve cords are separate; the first pair of nephridia is larger than the others; the setæ occur in bundles of 15–17 on each side of the ventral surface; the body is colourless and almost transparent, about 10 mm. in length, with about 20 segments.

The animal usually clings to a water-snail; the locomotion is mainly by the suckers; the anterior setæ help in seizing the prey (small crus-

* Arch. Entw., xviii. (1904) pp. 415–51 (7 figs.).
† Zeitschr. wiss. Zool., lxxix. (1905) pp. 548–73 (2 pls.).
‡ Arch. Zool. Expér., xxxiii. (1905) pp. 338–89 (4 pls.).
§ Journ. and Proc. Asiatic Soc. Bengal, i. (1905) pp. 117–20 (1 pl. and 1 fig.).

taceans) and conveying it to the mouth. There is budding from t penultimate segment, followed by fission.

Polian Tubes in Sipunculus.*—F. Ladreyt has studied the t tubes which lie dorsally and ventrally on the œsophagus of *Sipuncul nudus* opening anteriorly into the peribuccal sinus, and posteriorly wi blind ends at the beginning of the intestinal coil. They are much m complex than has been supposed, and show several differentiated region (1) A hæmatolytic region (posterior part of the ventral tube); (2 lymphogenic region (anterior part of the gland associated with dorsal tube); (3) an excretory region (posterior wall of the glan They may be regarded as lympho-renal organs.

Regeneration of Head End of Ophryotrocha puerilis.†—C. Cz klitzer reports some striking cases of regeneration in this Anne After removal of the first segment, in one case, degenerative proce set in for six weeks; there was a loss of cirri, setæ, and most of parapodia; then degeneration stopped, and a week later there wa complete regeneration of all the lost parts. If the first segment removed, the second may take on the characters of the head, to s extent at least. When the first two segments were removed, there no regeneration. The first segment can repair its own minor inju very rapidly.

Species of Polynoinæ.‡—L. Alaejos y Sanz gives a descrip account of some species of Polynoinæ from the coasts of Santan Among others described and beautifully figured are the following: *I donotus clava*, *Halosydna gelatinosa*, *Hermadion pellucidum*, *Harm spinifera*, and five other species of *Harmothoë*.

Regeneration in Annelids.§—E. Schultz, in the course of a discussion of the various modes of regeneration which occur in Anne emphasises the fact that "un-differentiation" up to a certain limit general preliminary process. Before re-differentiation (sometimes new line) occurs, there is this process of "un-differentiation." Mor genetic processes are reversible. Some interesting experiment starving Planarians (*Planaria lactea*) show that many organs and may return to their embryonic level.

Japanese Palolo.‖—Akira Izuka gives an account of some o internal structures of *Ceratocephale osawai*, the Japanese *Palolo*. discusses the circulatory system, the nervous system, and the neph which are essentially the same as those of *Nereis diversicolor* desc by Goodrich.

Philippine Gephyreans.¶—I. Ikeda reports on some Gephy collected by Professor B. Dean at Southern Negros (Philippine Isl including *Phascolosoma quadratum* sp. n., *Phymosoma deani* sp. n. *Thalassema manjuyodense* sp. n.

* Arch. Zool. Expér., iii. (1905) Notes et Revue, ccxv.-ccxxii. (4 figs.).
† Arch. Entw., xix. (1905) pp. 140-7 (7 figs.).
‡ Mem. R. Soc. Españ. Hist. Nat., iii. (1905) pp. 5-76 (12 pls. and 5 figs.
§ Trav. Soc. Imp. Nat. St. Pétersbourg, xxxiv. (1904) pp. 1-137 (5 pls. and
‖ Annot. Zool. Japon, v. (1905) pp. 238-52 (1 pl.).
¶ Tom. cit., pp. 169-74 (1 pl.).

Origin of Centrioles of First Cleavage Spindle in Myzostoma.*—K. Kostanecki has made an experimental study of this question in reference to *Myzostoma glabrum*, and concludes that the centrioles of the first cleavage spindle are certainly derived from the spermatozoon.

Nematohelminthes.

Spermatozoa of Ascaris megalocephala.†—L. Scheben finds that the enigmatical refractive body is a not unimportant component of the spermatozoon, which has a role in fertilisation. Peculiar as the whole spermatozoon is, it is deducible from the typical form.

The author describes the genesis of the spermatozoon from the spermatid, the fully formed spermatozoon, and the apical portion, which has been hitherto overlooked. The general result is that the spermatozoon is much less divergent than it looks.

The process of fertilisation is discussed, and an interesting case of polyspermy is reported. Scheben also describes the nutritive-cells and peculiar glandular-cells in the uterus.

Cutaneous Infection with Ankylostomum.‡—Gino Pieri has made experiments which, along with those of other workers, lead him to the following conclusions. Man is infected either by ingestion of the mature larva, *Leichtenstern*, or by its active penetration through the skin. This applies to *Uncinaria americana* Pieri as well as to *Ankylostomum duodenale* Looss. The dog is infected (1) when it ingests mature larvæ of *Dochinius trigonocephalus* Leuckart, or of *D. stenocephalus* Railliet; (2) when the mature larvæ of *D. trigonocephalus* are deposited on the skin (Looss), or are inoculated hypodermically (Calmette and Bréton), or are injected into the peritoneal cavity (Lambinet). Pieri's experiments show that the mature larvæ of *D. trigonocephalus* infect the dog, whether deposited on the skin or injected hypodermically. Penetration through the skin seems to produce more certain and abundant infection than introduction through the mouth.

Migration of Trichina Embryos.§—C. Stäubli concludes from his observations, which support those of Akanazy, that the embryos pass from the gut into the lymphatic system and thence to the thoracic duct. With the lymph current, helped perhaps by their own movements, the embryos gain the blood-vessels and are passively borne to the musculature, becoming most abundant in muscles which are very active and have an abundant blood supply.

Platyhelminthes.

Parasitic Turbellaria.‖—M. Plehn describes, from the blood of carp and tench, two Rhabdocœle Turbellaria about 1 mm. long. One, larger, has pointed hook-like bristles on the edge of the body in a

* Bull. Internat. Acad. Sci. Cracovie, 1905, pp. 411–16.
† Zeitschr. wiss. Zool., lxxix. (1905) pp. 397–431 (2 pls. and 3 figs.).
‡ Atti R. Accad. Lincei Roma, xiv. (1905) pp. 547–54.
§ Vierteljahrschr. Nat. Ges. Zürich, l. (1905) pp. 163–76.
‖ Zool. Anzeig., xxix. (1905) pp. 244–52.

regular row, *Sanguinicola ormata*, g. et sp. n.; the other, which is m common, is without hooks, *S. inermis*, sp. n. They are the type new family, Rhynchostomida, whose diagnosis is as follows. Rhal cœlida with pharynx entirely reduced; at end of straight foregut 4–6 large cæca in a rosette formation. Mouth at the tip of proboscis-like anterior end. Two sex openings present, ov distributed over the greater part of the body, surrounding the t which are limited to a medium strip. The copulatory organ is red to a blunt papilla. The brain is absent; so also are sense-org There are two longitudinal nerve-trunks with an anterior commis The excretory pore is at the hinder end; the two main lateral tr unite into a single short exhalant duct.

Migrations of Planarians in Mountain Streams.*—Walter V continues his studies on the distribution of species of *Planaria* in mountain streams of Rheinland. He distinguishes (*a*) migratio individuals, both occasional and periodic, and (*b*) gradual alteratio progress since the last glacial epoch in the distribution of parti species. The factors prompting migration are discussed in detail the search that a species makes for its particular optimum temperat

Effect of Starving on Planarians.†—F. Stoppenbrink has some interesting experiments on fresh-water Triclads, e.g. *Pla gonocephala*, *P. alpina*, *Dendrocœlum lacteum*, and *Polycelis nigra*.

The effect of reduced nutrition is seen externally in reducti size and change of form. Gradually all the cells become smalle dispensable organs degenerate and disappear. There is no great d tion in the nervous, alimentary, and excretory systems, or in the chyma, musculature, and epithelium, but the gonads undergo degeneration, first the yolk-glands, then the copulatory app finally the ovaries and testes. There is no phagocytosis. The i tion of the genital system is in the inverse order of its developmen

Sexual Organs of New Polyclad Genus.‡—E. M. Herzig de the genital organs in *Laidlawia trigonopora* g. et sp. n., whose con tion presents certain peculiarities. There are five pairs of ovari an accessory female genital pore, which opens near the posterior e the dorsal side, leading into a bursa in which sperms were found.

Terrestrial Planarians.§—Bruno Busson gives an account structure of *Pelmatoplana willeyi* sp. n., from Loyalty Island some South American species of *Geoplana*.

Parasites of Fishes.‖—Jas. Johnstone reports on various i parasites and diseased conditions in fishes. He discusses *Di* (?) *valdeinflatum* Stossich, from the muscles of *Pleuronectes lin*

* Verh. Nat. Ver. Rheinland, lxi. (1905) pp. 103–78.
† Zeitschr. wiss. Zool., lxxix. (1905) pp. 496–547 (1 pl. and 1 fig.).
‡ Zool. Anzeig., xxix. (1905) pp. 329–32.
§ SB. Akad. Wiss. Wien, cxii. (1903, received 1905) pp. 375–429 (1 pl. an
‖ Trans. Liverpool Biol. Soc., xix. (1905) pp. 278–300 (4 pls. and 5 figs.

Gasterostomum gracilescens Rudolphi from the brain membranes of Gadidæ, with its final host in *Lophius*; *Gasterostomum* sp. from the muscles of the plaice, and another from the cockle which also contains *Cercaria fissicauda*. Among the Cestodes noted are the following: *Dibothrium* (= *Bothriocephalus*) *punctatum* Rudolphi in brill, etc.; *Tetrarhynchus tetrabothrius* van Beneden from the pike and dogfish, and *T. erinaceus* van Beneden from the gurnard. The author also notes *Echinorhynchus acus* from the haddock, and *Lymphocystis johnstonei* Woodcock (a sporozoan) from flounders. Pearl-like concretions in gurnard, etc., are probably due to *Tetrarhynchus* cysts.

New Bilharzia in Man.*—Looss points out that *Schistosoma cattoi* described by John Catto (1905), is the same as *Schistosomum japonicum* described by Katsurada (1904). It is remarkable that the same new parasite should have been found about the same time at Singapore and in Japan. Looss gives some account of the new form.

Scolex of Idiogenes.†—N. Cholodkovsky has found a species of *Idiogenes* (*I. grandiporus* from *Otis tetrax*) with a well-developed scolex with 104 hooks, a discovery which makes it possible to refer this genus to its place in the system, namely, close beside *Dilepis*.

Cestode Studies.‡—Th. Pintner gives an account of the "frontal glands" which develop on the wall of the bladder-worm stage of *Rhynchobothrius adenoplusius* sp. n., and extend over the scolex-primordium. Their primary openings are on the most anterior margin of the scolex; they attain their maximum activity when the scolex is fully formed within the bladder; they afterwards begin to atrophy. Over the whole surface of the larval body there are very numerous unicellular glands—which the author calls "Finnendrüsen." The integument of the animal is fully discussed, and there are notes on the structure of *Amphilina* and the cuticle of *Tænia saginata*.

Mammalian Cestodes.§—J. Bourquin gives a detailed account of the anatomy and histology of *Bertia studeri*, *B. elongata*, and *B. plastica*, parasites from *Troglodytes niger* and *Galeopithecus volans*. The paper includes a discussion of the differences of the first-named from *B. mucronata* and *B. conferta*, to which it bears several resemblances.

Cestodes from a Porpoise.‖—E. Linton describes bladder-worms from the mesentery of *Lagenorhynchus acutus*, probably the same as Chamisso found long ago, and Rudolphi described in his synopsis as *Cysticercus delphini*. Another form which Rudolphi described in his history of Entozoa as *Cyst. delphini* should be referred to the genus *Phyllobothrium*. The final stage of the form here discussed, for which the title *Tænia chamissonii* is proposed, is probably in another mammal, e.g., *Orcinus orca*.

* Centralbl. Bakt. Parasit., xxxix. (1905) pp. 280–5.
† Zool. Anzeig., xxix. (1905) pp. 580–3 (5 figs.).
‡ SB. Akad. wiss. Wien, cxii. (1905) pp. 541–97 (4 pls.).
§ Revue Suisse Zool., xiii. (1905) pp. 415–506 (8 pls.).
‖ Proc. U.S. Nat. Mus., xxviii. (1905) pp. 819–22 (1 pl.).

Helminthological Studies.*—M. Kowalewski continues his hel thological researches, and describes *Hymenolepis arcuata* from intestine of *Fuligula marila*, and *H. parvula* from the common duck

Rotatoria.

Male of Eosphora digitata.†—P. de Beauchamp describes structure of this male, which is remarkable in being less degene than usual. Its form is like that of the female, its size is not n less. Its corona, brain, foot, muscles, excretory canals, etc., are like those of the female. The gut is a cul-de-sac without mastax, only two regions, quite empty, probably non-functional. In posterior half of the body lay the large globular testis, contai numerous spermatozoa of large size. This male was previously but not described, by C. F. Rousselet.

Incertæ Sedis.

New Brachiopod.‡—Stuart Weller describes a *Paraphorhynch* new genus of Brachiopods from the Kinderhook fauna of the Missis Valley. The genus is established to include some rather large, coa plicate, Rhynchonelloid shells, usually with simple plications, and the entire surface covered with very fine radiating striæ.

Oscillating Circulation in Phoronis.§—P. Enriques describes he calls the oscillating circulation in *Phoronis psammophila*, the l showing what may be called a rapid ebb and flow first in one dire and then in the other within the vessels — an apparently u phenomenon.

Young Discinisca.‖—N. Yatsu brings forward additional evi to show that the structure in the larval Brachiopod *Discinisca* Blochmann maintains to be the nephridium is really the otocy statocyst. There is a distinct pair of nephridia, probably appe about the stage with five pairs of cirri. Anteriorly they open nea lateral ganglia, and run along the ventral body-wall. Posteriorly dilate into funnels, which are suspended by the ileo-parietal b The otocysts are small and inconspicuous as compared with the *Lingula* of the same stage, and it is probable that their prec diminution in size is correlated with an earlier attachment of the la

Echinoderma.

Axial Organ and Ventral Blood Spaces in Asterids.¶—V Pietschmann has studied the difficult problem of these structu starfishes, and has come to the following conclusions:

1. The axial organ, a local proliferation of the interbrachial se consists of three parts histologically and functionally different: (a)

* Bull. Internat. Acad. Sci. Cracovie, 1905, pp. 532–4 (1 pl.).
† Arch. Zool. Expér., iii. (1905) pp. ccxxv.–ccxxxiii. (3 figs.).
‡ Trans. Acad. Sci. St. Louis, xv. (1905) pp. 259–64 (1 pl. and 7 figs.).
§ Atti R. Accad. Lincei Roma, xiv. (1905) pp. 451–4.
‖ Zool. Anzeig., xxix. (1905) pp. 561–3 (2 figs.).
¶ Arbeit. Zool. Inst. Univ. Wien, xvi. (1905) pp. 63–86 (2 pls. and 5 figs.)

main median portion is the seat of lymphocyte formation, and the connection with the oral blood-ring is similar; (*b*) the upper lateral appendix probably forms no lymph-cells, but, as it contains muscular elements, has probably some contractile capacity; (*c*) the lower distal portion is an excretory vesicle.

2. The median lymph-forming portion is united to the oral vascular plexus in the annular septum by the connecting portion already mentioned; the axial sinus opens into the internal oral perihæmal canal.

3. There are muscle-fibres in the annular and in the radial septum.

4. The blood-spaces in the rays occur especially in the transverse bands and lateral "Kölbchen," from which blood channels pass to the tube-feet, forming an annular sinus at their ends.

Parthenogenesis in Sea-Urchin Ova.*—C. Viguier re-states his conclusion that in the course of one season the eggs of the sea-urchin pass through a succession of stages: (1) even when apparently ripe they may after fertilisation produce ova whose development is soon arrested; (2) when fertilised they form perfect larvæ, when not fertilised they do not develop; (3) when fertilised they form perfect larvæ, but they may also produce parthenogenetically less advanced larvæ; (4) they may develop much in the same way whether fertilised or not; (5) the fertilised ova are arrested or lag behind the parthenogenetic ova.

Hybridisation of Sea-Urchin and Comatula.†—E. Godlewski jun. states that he has succeeded in rearing plutei from *Echinus*-ova fertilised by *Antedon*-spermatozoa when the sea-water is altered in its alkalinity by adding some solution of sodium hydrate. In spite of the nuclear union there is in the larva no hint of paternal characteristics. Fertilisation and mingling of hereditary characters are two quite distinct processes. It seems to the author unjustifiable to regard the chromatin-substance as the sole vehicle of the hereditary qualities. The experiments show that the ovum-cytoplasm must count for much.

Muscles of Pedicellariæ.‡—E. Kiernik has found in *Paracentrotus* and *Parechinus* (as Hamann did in *Echinus acutus*) six neuroderm organs, two for each blade. In the adductor muscles there are true striped muscles along with smooth muscles. The extensors and flexors consist entirely of smooth muscle fibres.

Antarctic Holothurians.§—Rémy Perrier reports on the collection in the Museum of Natural History in Paris, and discusses the question of bipolarity. His view is that we cannot speak of a bipolar fauna, though there are bipolar species, whose distribution must be separately interpreted in each case. In most cases the bipolar species are the relics of very widely distributed species, whose inter-tropical representatives have been eliminated by the keen struggle in tropical regions or by relatively recent climatic changes.

* Arch. Zool. Expér., iii. (1905) Notes et Revue, pp. ccvii.–ccxii.
† Bull. Internat. Acad. Sci. Cracovie, 1905, pp. 501–6.
‡ Tom. cit., pp. 520–32 (1 pl.).
§ Ann. Sci. Nat. Zool., ser. 9, i. (1905) pp. 83–146 (5 pls. and figs.).

Cœlentera.

Rheotropism of Hydroids.*—P. Hallez has shown that *Boug villea ramosa* Van Beneden, grown in troubled waters, develops a l number of stolons and takes on an appearance very different from normal, so different that it has been described as a separate sp *B. fruticosa* Allman. He has also experimented with *Eudendrium Halecium*, and the result of reaction to the movements of the water rheotropic reaction) is especially an excessive development of st which serve to consolidate the colony. But though this proliferati the stolon system changes the appearance of the colony, it is not than a secondary effect.

New Pelagic Cœlenterate.†—C. Dawydoff describes *Hydr salenskii* g. et sp. n., three species of which he found at the Moluccas its umbrella, velum, manubrium, and some other features it rese a craspedote medusoid, but in its aboral sensitive organ, its tent apparatus, and in some details of its gastrovascular system (e.g. an unpaired canal towards the aboral pole, two special lateral or tent canals) it suggests the Ctenophora. The author's general view affinities of his new type may be indicated in this scheme :

Hydromedusæ (especially Narcomedusæ). ↗ *Hydroctena*——————Ctenophora
↘ *Ctenoplana*—*Cœloplana*—Turbellaria

Spicule Formation in Alcyonium.‡—W. Woodland finds spicule first appears in the cytoplasm of a scleroblast as a small sp concretion, and remains approximately spherical until the divisio two of the nucleus. It then becomes somewhat dumb-bell like, a two nuclei usually travel to its opposite ends. In the next s somewhat resembles a caudal vertebra, and like preceding and suc stages is enclosed in a granular protoplasmic sheath containi nuclei, which are usually situated at the extremities. As to the forms of adult Alcyonarian spicules, the author makes two sugg Growing spicules situated in a mass of mesoglœal substance far r from any limiting surface must, owing to the proximity of other s endodermal canals, and other heterogeneities of constitution of t rounding medium, necessarily be subject to an aggregate of in which tend to produce irregularity of form ; and the second is t extension of a growing body into a surrounding resistant me most easily effected by the protrusion of more or less acute p which, in virtue of their acuteness, are best able to cleave a pass

Porifera.

Oscules of Cinachyra.§—R. Kirkpatrick has some notes genus of Tetractinellids, with especial reference to *C. barbata* specimens of which were obtained by the 'Discovery' from the A

* Comptes Rendus, cxli. (1905) pp. 727–30.
† Mem. Acad. Imp. Sci. St. Pétersbourg, xiv. (1903, received 1905) pp. 1-
‡ Quart. Journ. Micr. Sci., xlix. (1905) pp. 283–304 (2 pls. and 2 figs.).
§ Ann. Nat. Hist., xvi. (1905) pp. 662–7 (1 pl.).

The specimens are spheroidal or ovoidal in shape and with a root-tuft; the surface bristles with a pile-like coat of spicules, which are mostly protrienes. Arranged round the sides of the sponge are flask-shaped recesses with oval or circular orifice, and with the margins guarded by a fringe of needles rising above the general surface; on the upper part of the surface are smaller orifices, likewise surrounded by a spicular fringe. Sollas regarded the flask-shaped recesses as being either vestibules or cloacas, and called them oscules for convenience of description. Kirkpatrick concludes that in the seven species of *Cinachyra* the depressions on the surfaces are probably in every instance poral vestibules, the oscules being separate and distinct.

Studies in Spicule Formation.*—W. Woodland has studied in particular the spicule formation in *Sycon coronata* and *S. ciliata*. His results are very different from those of Maas, as may be thus shown:

MAAS.	WOODLAND.
Each monaxon arises in a single mother-cell.	No trace of the spicule occurs until the mother-cell has constricted into two nucleated portions.
There is never more than one cell on the smaller monaxons.	There are never less than two.
The large monaxons have numerous formative cells upon them, derived from the dermal layer *de novo*.	The largest monaxons, in the two species studied, have never more than two formative cells; when there are four, as in some Ascons, these probably arise from the original mother-cell (or cells).
The triradiates arise each in a single mother-cell as a concretion, but at a later stage they bear several formative cells.	The triradiates are derived from three mother-cells which have associated together, and built up by their six division products. There are no additional formative cells.

The author expounds two laws of spicule formation:—(1) the necessity of the proximity of the cell-substance to the site of lime secretion; and (2) in Calcarea, the necessity of the presence of two masses of dermally-derived cell-substance, between which the young spicule is deposited. From these he proceeds to explain the existence of the three kinds of spicules characteristic of calcareous sponges, showing not only why the three kinds occur, but also why other kinds do not. The modes of disposition and secondary forms of the spicules are the inevitable results of environmental influences operating during the course of each individual ontogeny.

Protozoa.

Structure and Movements of Protoplasm.†—K. C. Schneider discusses the structure and movements of the plasma in Foraminifera,

* Quart. Journ. Micr. Soc., xlix. (1905) pp. 231–82 (3 pls. and 11 figs.).
† Arbeit. Zool. Inst. Univ. Wien, xvi. (1905) pp. 99–118 (4 pls.).

Radiolaria, Heliozoa, Amœbæ, Infusorians, Gregarines, etc. On concrete basis he erects an elaborate theory. The hyaloplasm cor of "Tagmas" and a homogeneous fluid intertagmal substance of li character, in which considerable quantities of water can be takei This lipoid is the "Arbeitsubstanz" which has to do with mover Various theories of plasmic movements are discussed—the surface tei theory and the coagulation theory especially. But they are reject inadequate. There is a specific living substance with specifically behaviour, and the tagmas are alive, with a directive role in relati the physical and chemical metabolism which goes on around them. regret that we cannot at present do more than notice this emphat vitalistic theory of protoplasm and its movements.

Observations on Arcella Vulgaris.*—E. Martini gives a full ac of the process of encystation, including the degeneration of the nı and the nucleolus-like bodies. Some interesting degenerative phen are described; it seems that over-feeding may be a cause. The qu of the secondary nuclei is discussed at length.

Entamœba Buccalis.†—S. Prowazek describes this amœba occurs in the cavities of hollow teeth. It varies in size from (and differs from *E. coli* in possessing a clearly differentiated ect endoplasm, and in its reproduction.

Amœbæ of Dysentery.‡—A. Lesage describes and compare *Entamœba coli* an amœba from the mucus of dysenteric patie Saigon and Toulon, which he regards as specifically differen distinctive feature appears to be the nature of its ecto- and end the absence of multiplication of the nucleus into 8 parts (as oc *E. coli*) and of the characteristic cysts of *E. coli*.

Foraminifera of Shore-Sand of Sussex.§—Arthur Earland an account of his gathering of Foraminifera from the sho between tide-marks at Bognor, Sussex. It proved to be an unexp rich collection, predominantly milioline, including no fewer th species, of which many are of rare occurrence in Britain, 15 are r for the first time, and one is new—*Spiroplecta fusca*. Both in tl number of species recorded and in the number of rare forms, will now take precedence of all other British collecting ground paper includes an account of the twin or "plastogamic" speci *Discorbina parisiensis* which were abundant. The two specimen in "plastogamy" are rarely the same in size and often n different; the apertures do not necessarily coincide, sometimes four or more are united more or less irregularly; in many insta two represent varying types, one being *D. parisiensis*, the othe the more compact *D. Wrightii*. In two cases the young brood within the parent shell.

New Rhabdosphere.‖—George Murray has found a n apparently very rare Rhabdosphere, which he calls *Rhabdosphæ*

* Zeitschr. wiss. Zool., lxxix. (1905) pp. 574-619 (3 pls.).
† Arb. Kaiserl. Ges., xxi. (1904). See also Centralbl. Bakt. Paras (1905) p. 646.
‡ Ann. Inst. Pasteur, xix. (1905) pp. 9–16.
§ Journ. Quekett Micr. Club, 1905, pp. 187–232 (4 pls.).
‖ Proc. Roy. Soc., series B, lxxvi. (1905) pp. 243–4 (1 fig.).

anima. Hitherto only two of these "most elusive organisms in natural history" have been known. The new form has sharp spinous processes in contrast to the trumpet-shaped and club-shaped processes of the two others. It is very minute, 10 μ, i.e. about one-quarter the size of *R. claviger*. It was obtained on the 'Discovery's' outward voyage to the Cape.

Alleged Senile Degeneration in Protozoa.*—P. Enriques has made prolonged observations on successive generations of *Glaucoma scintillans*, *Stylonichia pustulata*, and *Vorticella nebulifera*, and has not found any proof of senile degeneration, though degenerative phenomena may be brought about through toxic bacterial influences. In the case of an isolated *Glaucoma scintillans* he observed 683 generations, during which there was no conjugation and no degeneration.

Alleged Senile Degeneration in Infusorians.†—P. Enriques has made observations on *Stylonichia pustulata* and *Vorticella nebulifera*, and comes to the conclusion that the alleged senile degeneration after prolonged fission is illusory. In healthy conditions there was no degeneration after about 700 generations by fission without conjugation. Experiment showed that bacterial influence may induce degenerative phenomena in young forms, and it is suggested that this occurred in the famous experiments of Maupas.

New Flagellate Parasites.‡—Anna Foà describes two new Flagellata from Chilian Termites, *Calonympha grassii* g. et sp. n., and *Devescovina striata* g. et sp. n. The former is a most remarkable animal, oval in form, with a zone of granules and long flagella at the narrower pole, further down a zone of long flagella, granules, and nuclei, and towards the broad pole a zone with remains of food. In the second zone each flagellum is continued into a nucleated ampulla with a granule at the entrance of the flagellum, and with a delicate filament continued inwards to join with other filaments in forming a sort of axial bundle. The second form is pear-shaped, longitudinally striated, with three fine anterior flagella, a hyaline axial rod, an anterior nucleus, and several features suggestive of *Jœnia*.

New Flagellate Parasite of Bombyx mori.§—C. Levaditi describes *Herpetomonas bombycis* sp. n. Its centrosome lies posteriorly to the nucleus, and there is a cytoplasmic prolongation of the flagellum, recalling the undulating membrane of trypanosomes, and a possible relationship is suggested. The hosts were suffering from pebrine and an undetermined microbic infection, so that the pathogenic role, if any, of *H. bombycis* could not be determined.

Flagellate Parasites.‖—S. Prowazek has, with the aid of *intra vitam* staining with neutral red and other reagents, successfully studied developmental stages in three parasites from the rectum and cloaca of

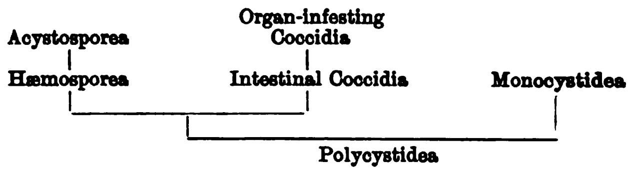
* Atti R. Accad. Lincei Roma, xiv. (1905) pp. 351–7.
† Tom. cit., pp. 390–5 (3 figs.). ‡ Tom. cit., pp. 542–6 (3 figs.).
§ Comptes Rendus, cxli. (1905) pp. 631–4.
‖ Arbeit. Kaiserl. Ges. Berlin, xxi. (1904); see Centralbl. Bakt. Parasit., xxxvi. (1905) pp. 645–6.

the wall-lizard. These are *Trichomastix lacertæ*, *Bodo lacertæ*, *Trichomonas lacertæ* sp. n. *Trichomastix* exhibits an alternatioı generations. There is an asexual phase where division takes ɪ amitotically, followed by an autogamous sexual generation. Herı individual encysts, its nucleus divides, forming two daughter-ı perhaps sexually differentiated. After the development of two direcı corpuscles, they fuse and form a new nucleus (Frischkern). The fuı development may follow different courses, of which one is the formı of a resting-cyst, which serves for fresh infection. *Bodo* also exh two generations; *Trichomonas lacertæ* increases by longitudinal divi Particulars regarding conjugation phenomena in other flagellate ı sites are given.

Trypanosome of El-debab.*—Edmond and Sergent describe parasite of El-debab, a fatal disease affecting dromedaries in N Africa. The disease appears to be caused by the prick of a speci gad-fly harbouring a trypanosome. The trypanosome occurs abund in the blood of infected animals, even when the symptoms are slig absent. It has an average length of 19 μ. The centrosome is relat large, and there are a few granules scattered in the protoplasm. M plication is by longitudinal division. It moves by lashing, twi movements of flagellum, which do not take it out of the fiel observation.

New Vorticellidæ.†—E. Fauré-Fremiet gives brief notes number of new or little known species of various genera obtain the vicinity of Paris. Ecto-parasitic species are specially numerouı show adaptations to their hosts, although they can live freely on hosts for a time.

Inter-relationships of the Sporozoa.‡—Howard Crawley dis this difficult question. He agrees with Minchin that both Coccid Hæmosporidia have arisen from common ancestors. These ancest their turn he believes to have been derived from the Polycystide his conception of the inter-relationships of the Telosporidia is ind by the following scheme:



New Species of Chloromyxum.§—H. Joseph describes *Chlorom protei* sp. n., a new Myxosporidian which occurs in multitudes, fill the canaliculi in the kidneys of *Proteus*.

* Ann. Inst. Pasteur, xix. (1905) pp. 17–48.
† Zool. Anzeig., xxix. (1906) pp. 480–2.
‡ Amer. Naturalist, xxxix. (1905) pp. 607–24.
§ Zool. Anzeig., xxix. (1906) pp. 450–1.

Glycogen in Sporozoa.*—Brault and Loeper describe in the rabbit infected with *Coccidium oviforme* a blocking of the bile canals with parasites. The young parasites were attached to the cell walls; the cells died off by degrees, and no sign of their actual invasion was observed. The coccidia at this stage were abundantly provided with glycogen, which they gradually lost as soon as they became encapsuled. The coccidia cause stretching of the bile canals, so that sometimes they are ruptured and the coccidia gain entrance to the blood vessels and are thus distributed.

* Journ. Phys. et Path. Gen., vi. (1904) pp. 720–32 (1 pl.). See also Centralbl. Bakt. Parasit., xxxvi. (1905) p. 689.

BOTANY.

GENERAL,

Including the Anatomy and Physiology of Seed Plants.

Cytology,

including Cell Contents.

Relation of Nucleus and Chromosomes.*—T. M. Mano h vestigated the behaviour of the nucleus in the somatic cells of *So tuberosum* and *Phaseolus vulgaris*. This work was mainly unde to test the views of Wager, which contradict those of Grégoir Wygaerts. Mano was unable to confirm the view of Wager th nucleolus is morphologically transformed into chromosomes, tho may furnish some substance for their development. The chrom are derived directly from the chromatic network in the prophase in the anaphase the nucleolus arises independently of the chromat work in the form of drops which flow together to form a nucleolar mass.

Achromatic Spindle of the Heterotypic Division.†—J. Berg investigated the development of the pollen-mother-cell of *Paris q folia*. The nucleus is extraordinarily large, but the richness nuclear material is not favourable for a study of the exact behav the chromosomes; the development of the achromatic spindle followed, however, with great clearness. In the development spindle the author observed no distinction of kinoplasm and t plasm in the sense of Strasburger, but finds that the spindle is formed by a rearrangement of the ordinary cytoplasmic reticulum. spindle is at first multipolar and becomes bipolar, not by a fusion various minor cones to form two, but by the withdrawal of the constituting the secondary cones into the general spindle.

Heterotypic Division.‡—J. Berghs, in two short papers, de his investigations of this division in the pollen-mother-c *Convallaria*, *Drosera*, *Narthecium*, and *Helleborus*. In all these c confirms the earlier view put forward by Grégoire and himsel the spireme is formed by the union side by side in synapsis filaments; that the later longitudinal splitting of the single th merely the reappearance of these two threads. Portions of these then become condensed to form the daughter-chromosomes, whic represent merely somatic chromosomes. The numerical reduc the prophase is thus merely apparent; the true reduction in

* La Cellule, xxii. (1905) pp. 57–77 (4 pls.)
† Tom. cit., pp. 202–14 (2 pls.)
‡ Tom. cit., pp. 43–58 (1 pl.); pp. 141–60 (2 pls.)

takes place later, when the daughter-chromosomes (i.e. somatic chromosomes) separate towards the two poles.

D. M. Mottier * has also investigated this division in *Podophyllum peltatum*. He now gives up his earlier view that a longitudinal fission occurs for each mitosis, and describes for this form *bivalent* chromosomes which are produced by the approximation of serially distinct parts of the spireme, each half being, however, double from the early longitudinal fission of the spireme. This work is thus a confirmation of the view as to the nature of this division put forward by Farmer and Moore and by Strasburger.

Karyokinesis in the Ascomycetes.†—A. Guilliermond returns to this subject, studying anew the plants already examined by him and by R. Maire. He finds himself in accord with Maire as regards the process of mitosis which precedes the formation of spores in *Galactinia succosa*. He found, in the first division he noted, the massing of the chromatin at one side of the nucleus in the synapsis stage, and the appearance of the protochromosomes which develop into 4 chromosomes. Spindle and centrosomes have an intranuclear origin. The asters are partly intranuclear and aid in forming the spindle, and they are partly derived from the cytoplasm of the cell. The single centrosome divides, and the two daughter-centrosomes move apart till they are placed opposite each other. At this stage the 4 chromosomes of the equatorial plate divide into 8 ; then a second stage was seen where 8 or a larger number could be counted on the spindle, and at the poles in the anaphase stage 4, 6, or 8 chromosomes were counted. The author agrees with Maire that this first division is heterotypic, the second and third, in which the number of chromosomes was invariably 4 on the equatorial plate and 4 at the poles, may be regarded as homotypic.

The development of the ascus was followed in similar detail in *Pustularia vesiculosa* and *Aleuria cerea*, in both of which the number of chromosomes was determined as 8 or about 8 in all the divisions examined (Maire determined them as 4 only). In *Peziza rutilans* were found 16 chromosomes in the first division massed at the centre of the nucleus ; two centrosomes make their appearance at the same time, and from them radiate the fibres of the spindle. At the poles 16 chromosomes were also counted in the anaphase stage. The karyokinesis of this form resembles that of other Ascomycetes in the prolonged persistence of the nuclear membrane, the intranuclear formation of the spindle, etc. etc. The author gives an account of the presence of metachromatic corpuscles, and basophil granules in the cells.

Studies on the Plant Cell.‡—B. M. Davis, in the eighth and concluding paper in this series, deals with the simplest types of plant cells, and compares them with cells exhibiting higher types of organisation. Other topics discussed are some apparent tendencies in the evolution of mitotic phenomena ; the essential structures of the plant cell and their behaviour in ontogeny ; and the balance of nuclear and cytoplasmic activities in the cell.

* Bot. Gazette, xl. (1905) pp. 171–7.
† Ann. Mycol., iii. (1905) pp. 343–61 (3 pls.).
‡ Amer. Nat., xxxix. (1905) pp. 695–740.

Structure and Development.

Reproductive.

Studies on the Araceæ.*—D. H. Campbell makes a further c tribution to our knowledge of the gametophyte, and the embryolog the Araceæ, by the study of a variety of *Anthurium violaceum* *Nephthytis liberica*. *Anthurium* closely resembles the usual an spermous type: the archesporium is a single hypodermal cell, wl divides periclinally; the primary sporogenous cell becomes the megas without division; there is no free nuclear division in the formatio endosperm, which proceeds from the antipodal towards the microp end of the sac; the embryo originates as an almost globular mas cells with a rudimentary suspensor. In *Nephthytis*, on the other h there is considerable variety; the archesporial cells are variabl number, and generally more than one embryo-sac begins to deve the form of the mature sac varies widely, in some cases containing two nuclei, in others twelve or thirteen. The author reiterates conviction that the Araceæ are relatively primitive monocotyledons.

Microspores of Araucaria Bidwillii.†—G. Lopriore describ multinuclear condition in the pollen-grains of this species. He that the spores germinate best in darkness in a 12 p.c. sugar solu the pollen-tubes reaching their greatest length in 8–10 days. As spore germinates, two lens-shaped cells are cut off; these divide to a mass of about 15 cells, the walls of which soon disappear, leavin nuclei free in the general cytoplasm. By further nuclear div the number is increased to 20–44 nuclei, 36 being the most freq Division ceases when the pollen-tube begins to develop. The au regards as vegetative nuclei two somewhat larger nuclei in the er the tube, while the others are regarded as equivalent to spermato C. J. Chamberlain,‡ however, in reviewing Lopriore's work, sug from an examination of the figures, that the two larger nuclei ar male nuclei, while the rest of the numerous nuclei represent an un prothallial development.

Physiology.

Nutrition and Growth.

Germination of Seeds of the Castor-Oil Plant.§—J. Rey Green and H. Jackson have made a series of observations which su ment the earlier researches of the former author. Their experi show that germination is associated with a remarkable activity c cells of the endosperm, which spring into renewed life and set up a complex metabolism. Their protoplasm grows and takes a prom part in these metabolic changes, secreting enzymes and settin various chemical changes in the cells, partly by means of the en and partly independently of them. The embryo also contributes

* Ann. of Bot., xix. (1905) pp. 329–49 (4 pls.).
† Ber. Deutsch. Bot. Ges., xxiii. (1905) pp. 335–46 (1 pl.).
‡ Bot. Gazette, xl. (1905) p. 391.
§ Proc. Roy. Soc., Series B, lxxvii. (1905) pp. 69–85.

enzyme-formation. The result is the production of a great variety of nutritive material, partly the direct product of enzyme-action, partly produced by the secretory activity of the protoplasm, and partly by the interaction of the products of the first two agents. Among the substances formed are two varieties of sugar, lecithin, fatty acids and the products of their oxidation, proteids and the products of their digestion, including various crystalline nitrogenous bodies, amino- and amido-compounds. The embryo absorbs from this mass of nutritive material, in which it is plunged, by means of the delicate epidermis of its cotyledons, probably selectively, what it needs for growth.

Analyses of the cotyledons showed them to contain a varying quantity of lecithin, amounting in some cases to 1·36 p.c. of their dry weight. Both the sugars can be detected in them; the relative amounts varied, but cane-sugar is usually present in largest quantity. The reaction of the sap is acid, traces of phosphoric acid being mixed with an organic acid. The transport of nutritive materials to the embryo seems similar to their transport in the tissue of the endosperm. Probably in both cases the presence of protoplasmic threads in the various cell-walls plays an important part in the matter; at any rate, this agency seems necessary to explain the transport of lecithin to the embryo. Thus the renewed metabolism in the endosperm-cells supplies a mass of nutritive material on which both the endosperm-cells and the young embryo feed, and there seems no particular difference in the manner in which they are severally nourished.

Irritability.

Irritability in Algæ.*—G. J. Pierce and Flora A. Randolph have studied the circumstances attending the attachment and germination of the zoospores of fresh-water and marine algæ. The germination of the zoospores of sessile algæ is apparently induced primarily by interference with their locomotion. The nature of the attachment formed by the germinating zoospores depends upon the roughness of the surface of the object with which they come into contact. Upon very smooth surfaces, such as the surface of clean water and clean wet gelatin, the spores form either only the shortest, most rudimentary holdfasts, or merely rhizoids; whereas on relatively rough surfaces the holdfasts are large, and conform in their lobing to the contour of the surface. Even ordinarily floating algæ may sometimes be induced to form rhizoids or other organs of attachment if brought into contact with sufficiently rough surfaces. The discharge of the spores or gametes of *Dictyopteris*, *Dictyota*, and *Cystoseira* is strongly influenced by light, being much more rapid within a few hours after exposure to light than before, or than in continuous darkness. Hence the time of the discharge as well as the rate is strongly influenced by light, and a periodicity is established which follows approximately that of daylight and darkness. The authors find, as shown by Winkler in *Cystoseira*, that the direction in which the light falls determines the place of the first division in the germinating spores of *Cystoseira*, *Dictyopteris*, and *Dictyota*, the new

* Bot. Gazette, xl. (1905) pp. 321–50 (27 figs. in text.)

cell-wall being at right angles to the incident rays. Similarly, rhizoids or holdfasts formed by germinating spores usually issue f the daughter-cells away from the light. In darkness they arise in possible directions, sometimes even from both cells of a germina spore. The direction of growth of rhizoid and plantlet is determi mainly by the direction from which the light comes: the rhizoids negatively, the plantlets positively, phototropic. The nature of surface largely controls the nature of the attachment formed, a ro surface inducing the growth of a large and well-developed hold while a smooth surface causes proportionately less growth. Though direction toward which the rhizoids ordinarily grow is determine first by light, the character of the surface with which the rhizoid co into contact still more strongly influences the direction of its gro Thus the direction, rate, and kind of growth of these germina spores is strongly influenced by contact irritation.

Galvanotropic Irritability of Roots.*—A. J. Ewart and Jess Bayliss, in view of the contradictory results obtained by Elfving Muller-Hettlingen, have reinvestigated this point. They have con the conclusion that the so-called galvanotropism of roots is really a ch tropic phenomenon due to stimulation by the products of electro of which the acid is more effective than the alkali, the latter also l neutralised more or less by the respiratory carbon dioxide. Tha galvanotropic or galvanogenic curvatures are not traumatropic in o is shown by the fact that they may be produced without any cells l killed.

Chemical Changes.

The Chemistry of some Common Plants.†—Under this tit Keegan discusses the chemical constituents of *Parmelia parietina* a lichens generally. He points out a striking difference between li and fungi; that whereas the latter are frequently poisonous, the f are always harmless, and also that their colouring matters are the pro of healthy de-assimilation, the colouring substances in fungi being decomposition or degradation waste products of the albuminoids. writer looks on lichens as higher organisms than fungi, physiolog speaking.

General.

Dispersal of Seeds by Wind.‡—H. N. Ridley, of the B Gardens, Singapore, gives the results of his observations on this su He recognises three types of seed-dispersal mechanism, namely, w fruits and seeds, plumed fruits and seeds, and "powder-seed," t dust-like bodies such as orchid-seed or fern-spores. He conclude the winged seed or fruit represents the slowest form of dispersa cannot cross a large stretch of sea, while the plumed seed or though well adapted for rapid carriage over open country, is liabl stopped by dense forest; the powder-seed represents the most rap

* Proc. Roy. Soc., Series B, lxxvii. (1905) pp. 63–6.
† Naturalist, 1905, pp. 274-5.
‡ Ann. of Bot., xix. (1905) pp. 351-63.

far-reaching method of dispersal. As the result of calculation from the maximum observed distance travelled by a winged fruit of a Dipterocarp (*Shorea leprosula*), 100 yards, the writer estimates that the species can spread only 300 yards in 100 years under the most favourable circumstances, and that a Dipterocarp would take one-and-a-half million years to spread from the Malay Peninsula to the Philippines, supposing that there were a land connection.

Chinese Flora.*—The issue of the index number marks the completion of an undertaking which has been on hand for nearly twenty years. W. T. Thiselton-Dyer contributes an historical note detailing the vicissitudes of the enterprise in explanation of the delay. Parts I. and II. of the Enumeration, for which Hemsley was directly responsible, were issued in 1886; for the remainder the co-operation of various botanists has been enlisted under Hemsley's editorship. Since the issue of the earlier parts our knowledge of the flora has been much enlarged by the work of several collectors, especially Augustine Henry, whose collections reached 15,700 numbers, amounting to some 150,000 sheets. The inequality between the earlier and later parts is to some extent remedied by a list, by M. Smith, of the new species published during the progress of the work, and of those previously described whose area has since been found to extend to China. The Index, by Daydon Jackson, of names including synonyms, contains about 17,000 entries.

Flora of Tropical Africa.†—A further instalment of this work contains the elaboration of several groups of Sympetalæ: Hydrophyllaceæ, by J. G. Baker and N. E. Brown; Boragineæ, by J. G. Baker and C. H. Wright; and the greater part of Convolvulaceæ, by J. G. Baker and A. B. Rendle. In dealing with the Convolvulaceæ the authors have employed in the determination of the genera and the larger subdivisions of the order, characters derived from the pollen-grain, on the lines suggested by Hans Hallier.

Botanical Glossary and Encyclopædia.‡—The new edition of B. Daydon Jackson's "Glossary of Botanic Terms" includes about 16,000 numbers, nearly three times as many as in any other previous work in the language. Owing to the original edition, which appeared in 1900, having been stereotyped, the new terms are included in the form of a Supplement; and for the majority of these the recent American presentment of plant ecology is responsible. The handy form in which the book is published, especially its lightness, in which it contrasts favourably with botanical handbooks generally, adds to its widely acknowledged value.

Another useful handbook § is owed to a group of botanists at Vienna,

* Journ. Linn. Soc. (Bot.) xxxvi. (1905) pp. i.-xi. and 457-686.

† Flora of Tropical Africa. Edited by Sir W. T. Thiselton-Dyer, iv. sect. 2 (1905) pp. 1-192. Lovell, Reeve and Co.

‡ Glossary of Botanic Terms. B. Daydon Jackson. London: Duckworth & Co. (1905) 371 pp.

§ Illustriertes Handwörterbuch der Botanik. Edited by C. M. Schneider, with the co-operation of v. Hoehnel, v. Keissler, Schiffner, Wagner, Zahlbruckner, and O. Porsch. Leipzig: Engelmann (1905) 8vo, viii. and 690 pp., 341 figs.

under the editorship of C. M. Schneider. It is a profusely illustr glossary and encyclopædia of botany. The work does not pretend t exhaustive, but to explain those terms which appeal to the ger botanical reader and student, omitting those of a purely descrip nature, such as will be found in most small handbooks, and those w are chemical, physical, and geological, rather than botanical, as wel those relating to micro-technique in the narrower sense. In most reference is given to the author of the term and its place of or In many cases the article forms a useful *résumé* of what is known subject, or of the present position of a theory, and the volume whole contains a large amount of information, as well as reference more exhaustive accounts.

KRUUSE, C.—**List of the Phanerogams and Vascular Cryptogams found on the (75°–66° 20′ lat. N.) of East Greenland.**
Medd. om Grönland, xxx. (1905) pp. 14

ZEILLER, R.—**Une nouvelle classe de Gymnospermes: les Ptéridospermées** new class of Gymnosperms—the Pteridospermæ.)
[A review of the recent discoveries of Scott, Oliver, ston, etc.] *Rev. Génér. Sci.* pp. 718–27 (7

CRYPTOGAMS.

Pteridophyta.

(By A. GEPP, M.A., F.L.S.)

ARBER, E. A. N.—**On some New Species of Lagenostoma, a type of Pt spermous Seed from the Coal Measures.**
[Two new species are described.]
Proc. Roy. Soc., 76B (1905) pp. 245–58 (2
Ann. of Bot., xix. (1905) pp.

BARGAGLI-PETRUCCI, G.—**I nucleoli durante la cariocinesi nelle cellule m matiche di Equisetum arvense.** (The nucleoli during karyokinesis in the stematic cells of *Equisetum arvense*.)
Nuov. Giorn. Bot. Ital., xii. (1905) pp. 69

BÉGUINOT, A.—**Appunti per una flora dell' isola di Capri.** (Contribution flora of the island of Capri.) *Bull. Soc. Bot. Ital.*, 1905, pp.

BERNATZKY, J.—**Die Farne des Deliblater Sandes und ihre pflanzengeogra Erklärung.** (The ferns of the Deliblat sand-region, and an explanation o occurrence.)
[The hollows in the sand are not necessarily dry, and *Scolopendr* found. Ferns of a drier habit are frequent.]
Annales Musei Hungarici, ii. (1904)

BERRIDGE, E. M.—**On two New Specimens of Spencerites insignis.**
[Fresh facts and variations.] *Ann. of Bot.*, xix. (1905) pp (2 pls.

BITTNER, K.—**Ueber Chlorophyllbildung im Finstern bei Kryptogamen** chlorophyll-formation in cryptogams in the dark.)
[An account of experiments which show that this property varies different groups of cryptogams, but is most marked in the ferns.]
Oesterr. Bot. Zeitschr., lv. (1905) pp.

BOCKWOLDT.—**Seltene Gefässkryptogamen aus der Flora von Neustad** (Rare vascular cryptogams of the flora of Neustadt in West Prussia.)
Schr. Naturf. Ges. Dantzig, xi. (1904

BRANDES, W.—**Zweiter Nachtrag zur Flora der Provinz Hannover.** (Second supplement to the flora of the Hanover Province.)
50–54 *Jahresb. Nat. Ges. Hannover*, 1905, pp. 137–221.

BROWN, R. N. R.—**The Botany of Gough Island. I. Phanerogams and Ferns.**
[Contains a list of 10 ferns, one of which is new. They were collected by the Scottish Antarctic Expedition.]
Journ. Linn. Soc. (*Bot.*) xxxvii. (1905) pp. 238–50 (3 pls.).

CAMPBELL, D. H.—**The Structure and Development of the Mosses and Ferns (Archegoniatæ).**
[Second edition, revised and enlarged.]
New York: Macmillan (1905) 657 pp., 322 figs.

CAPELLE.—**Kann man die Farnarten an ihren Wurzelstöcken sicher bestimmen ohne Zuhilfenahme ihrer Wedel?** (Can one distinguish with certainty the species of ferns from their rootstocks and without the help of their fronds?
[A comparison of the rhizome of *Aspidium filix-mas* with that of *A. filix-femina*, *A. spinulosum*, etc.]
50–54 *Jahresb. Nat. Ges. Hannover*, 1905, pp. 127–9.

CARDIFF, J. A.—**Development of Sporangium in Botrychium.**
Bot. Gazette, xxxix. (1905) pp. 340–7.

CHANDLER, S. E.—**On the Arrangement of the Vascular Strands in the "Seedlings" of certain Leptosporangiate Ferns.**
[Seventeen species were investigated.]
Ann. of Bot., xix. (1905) pp. 365–410 (3 pls.).

CHRIST, H.—**Filices Borneenses.** (Ferns of Borneo.)
Ann. Jard. Bot. Buitenzorg, xx. (1905) pp. 92–140 (1 pl.).

„ „ **Filices Cadierianæ.** (Ferns collected by Père Cadière.)
[Conclusion.] *Journ. de Bot.*, xix. (1905) pp. 69–79.

„ „ **Filices Cadierianæ. Appendice.** (Ferns collected by Père Cadière. Supplement.)
[List of 6 species from Annam; two are described as new.]
Tom. cit., pp. 125–7.

„ „ **Filices Mexicanæ. 1. German Munch.** (Mexican Ferns.)
[List of Ferns gathered by G. Munch in the Province of Chiapas, including 7 new species and one new variety.]
Bull. Herb. Boissier, v. (1905) pp. 725–35.

„ „ **Filices Uleanæ Amazonicæ.** (Ferns of the Amazon collected by Ule.)
[A list of 36 species collected in Brazil and Peru, 11 of the species being new. Trichomanes are well represented.]
Hedwigia, xliv. (1905) pp. 359–70.

„ „ **Zur Farnflora von Celebes.** (On the Fern-flora of Celebes.)
[List of 49 Pteridophytes collected by P. & F. Sarasin; 9 are described as new.]
Ann. Jard. Bot. Buitenzorg, xix. (1904) pp. 33–45.

CHRISTENSEN, C.—**Index Filicum.** (Index of Ferns.)
[Carries the enumeration forward from *Doryopteris capensis* to *Gleichenia cryptocarpa*.] *Hafniæ* (Hagerup, 1905) fasc. v. pp. 257–320.

CHURCHILL, J. R.—**Three Plants new to Vermont.**
Rhodora, vii. (1905) pp. 99–100.

COCKAYNE, L.—**Notes on the Vegetation of the Open Bay Islands.**
Trans. New Zealand Inst., xxxvii. (1905) pp. 368–77.

COPELAND, E. B.—**The Polypodiaceæ of the Philippine Islands.**
[Descriptions of all the species, with keys to the families, genera and species.]
Bureau of Government Laboratories, Manila, No. 28 (1905) pp. 1–139.

COULTER, J. M.—**Pteridospermaphyta.** *Science* (n.s.) xx. (1904) p. 149.

DEWALQUE, G.—**Ueber einige seltene Farne vom Hohen Venn.** (On some Ferns of the Hohe Venn.]
Verh. Nat. Ver. preus. Rheinlande, Westfalens. 1904 (1905) p.

FERNALD, M. L.—**An Alpine Adiantum.**
[*A. boreale* Presl. is considered to be the same as *A. pedatum* var. *aleut* Rupr., abundant on the Shickshock Mountains of the Gaspé Penins
Rhodora, vii. (1905) pp. 1

FIELD, H. C.—**Notes on Ferns.**
[*Lomaria vulcanica* var. *repens*, a new variety with creeping rhiz *Nephrodium unitum*, a curious form; and an adiantoid form of . *dium Richardi*.]
Trans. New Zealand Inst., xxxvii. (1905) pp. 3

FUTÓ, M.—**Polypodium vulgare L. és P. vulgare v. serratum Willd.**
Növén. Közlem., iv. (1905) pp.

GILLOT, X.—**Partitions anormales d'Asplenium Trichomanes L.** (Abnormal sions in *A. Trichomanes*.) *Bull. Soc. Bot. France*, 1904 (sess. jubil.) pp. xc

GRAVAGNO, S.—**Nesso fra le crittogame vascolari e le fanerogame gimnosp** (Relation between the vascular cryptogams and the gymnospermous pl rogams.) Messina: Trinchera, 1904, 16mo, 4

GWYNNE-VAUGHAN, D. T.—**On the Anatomy of Archangiopteris Henryi and Marattiaceæ.**
Ann. of Bot., xix. (1905) pp. 259–72 (

„ „ **On the possible existence of a Fern Stem havin form of a Lattice-work Tube.**
New Phytologist, iv. (1905) pp. 211–16 (

HANDEL-MAZZETTI, AND OTHERS.—**Beitrag zur Kenntniss der Flora von Bosnien.** (Contribution to a knowledge of the Flora of West Bosnia.)
[Contains list of 18 Pteridophytes.]
Oesterr. Bot. Zeitschr., lv. (1905) pp. 3

HOLLICK, A.—**Additions to the Palæobotany of the Cretaceous Formation on Island.**
[Contains descriptions and figures of *Marsilea Andersoni* sp. n.]
Bull. New York Bot. Gard., iii. (1905) pp. 403–18 (1

ICHIMURA, J.—**Supplement to "The List of Plants collected in Mt. Hakus its vicinities."**
[Contains four Pteridophytes.] *Bot. Mag. Tokyo*, xix. (1905) pp.

JONES, C. E.—**The Morphology and Anatomy of the Stem of the genus Lycop**
Trans. Linn. Soc., ser. 2 (Bot.) vii. (1905) pp. 15–35 (

KEEGAN, P. Q.—**The Chemistry of some Common Plants.**
[Contains analytical notes on *Polypodium vulgare*.]
Naturalist, No. 584 (1905) pp.

KELLERMAN, W. A.—**The Gray Polypody in Ohio.**
[Supplementary Note on the distribution. See Tidestrom.]
Torreya, v. (1905)

KIDSTON, R.—**On the Fructification of Neuropteris heterophylla Brongn.**
Phil. Trans., No. 197, Series B (1904) pp. 1–5

„ „ **On the Internal Structure of Sigillaria elegans of Brong "Histoire des Végétaux fossiles."**
Trans. Roy. Soc. Edinburgh, xli. (1905) pp. 533–50 (

KIDSTON, R. & E.—**Preliminary Note on the occurrence of Microsporar organic connection with the Foliage of Lyginodendron.**
Proc. Roy. Soc., No. 76 B (1905) pp. 358–60

KLUGH, A. B.—**The Horsetails and Club-Mosses of Wellington County, Onta**
Amer. Bot., viii. (1905) p

Lipsky(?), A.—Plantæ Kronenbergianæ.
[Botanical results of A. Kronenberg's travels in the Caucasus, Persia, and Central Asia, 1901–4. Contains a list of 14 Pteridophytes.]
Allgem. Bot. Zeitschr., xi. (1905) pp. 129–35.

Leavitt, R. G.—Trichomes of the Root in Vascular Cryptogams and Angiosperms.
Proc. Boston Soc. Nat. Hist., xxxi. (1904) pp. 273–313 (4 pls.).

Lehmann, C. E. J.—Ueber die Giftigkeit der deutschen Schachtelhalmarten, insbesondere des Duwocks (Equisetum palustre). (On the poisonous nature of the German equisetums, especially the "Duwocks.")
[The injurious substance is a new alkaloid, equisetin, which the author has extracted from *E. palustre*.]
Arb. Deutsch. Landw. Ges., heft 100 (1905) (2 pls.).

Lyon, F.—The Spore-coats of Selaginella.
[An attempt to follow out and interpret correctly the mode of formation of these structures.] *Bot. Gazette*, xl. (1905) pp. 285–95 (2 pls.).

Maslen, A. J.—The Relation of Root to Stem in Calamites.
Ann. of Bot., xix. (1905) pp. 61–73.

Maxon, W. R.—A New Cloak-Fern from Mexico.
[*Notholæna bryopoda*.] *Proc. Biol. Soc. Washington*, xviii. (1905) pp. 205–6.

" " **A New Fern from Porto Rico.**
[*Polystichum Krugii* is separated as a new species from *Aspidium rhizophyllum*.] *Tom. cit.*, pp. 215–16.

" " **A Study of Certain Mexican and Guatemalan Species of Polypodium.**
[*P. biserratum* Mart. & Gal. appears to be a synonym of *P. subpetiolatum* Hook., which species is here defined, and from which are separated off *P. æquale*, *P. Teresæ*, *P. firmulum*, *P. fissidens*, *P. adelphum*—all described and figured as new species. *P. legionarium* Bak. and *P. fraternum* Cham. and Schlecht. receive comment.]
Contrib. U.S. Nat. Herb., viii. 3 (1903) pp. 271–6 (2 pls.).

Miller, H.—Weiterer Beitrag zur Flora des Kreises Bomst. (Further contribution to the flora of the Bomst district.)
Zeitschr. Nat. Abt. Ges. Kunst. Wiss. Posen (Bot.), xi. (1904) pp. 4–10.

Nathorst, A. G.—Die oberdevonische Flora des Ellesmerelandes. (The Upper Devonian Flora of Ellesmereland.)
Report Second Norwegian Arctic Exped. "*Fram*" (1904) 22 pp., 7 pls., 4 figs.

Oliver, F. W.—Ueber die neu entdeckten Samen der Steinkohlenfarne. (On the newly discovered seeds of Carboniferous Ferns.)
Biol. Centralbl., xxv. (1905) pp. 401–16 (6 figs.).

Ostenfeld, C. H.—A list of Plants collected in the Raheng District, Upper Siam, by E. Lindhard.
[A list published from the Botanical Museum of Copenhagen, and containing 7 Pteridophytes, of which two are new—*Selaginella Ostenfeldii* and *S. Lindhardii*.] *Bull. Herb. Boissier*, v. (1905) pp. 709–24.

Praeger, R. L.—Achill Island Plants.
[Short list of additions to the flora, a rare plant being *Lycopodium inundatum*, previously known in Ireland at four stations only.]
Irish Naturalist, xiv. (1905) pp. 220–1.

" " **The Parsley Fern in Co. Wicklow.**
[An isolated specimen was found in a wild spot near Lough Nahanagan; otherwise it is known only in the North of Ireland.] *Tom. cit.*, p. 222.

Raciborski, M.—O rodzaju paproci Allantodia Wall. (On the Fern-genus *Allantodia* Wall.) *Bull. Internat. Acad. Sci. Cracovie*, 1905, pp. 346–9.

RIPPA, G.—**Le Pteridofite raccolte da G. Zenker al Congo.** (The Pteridoph collected by G. Zenker on the Congo.)
Bull. Orto Bot. Napoli, ii. (1904) pp. 109

RUDOLPH, K.—**Psaronien und Marattiaceen, vergleichend anatomische Ui suchung.** (Psaronieæ and Marattiaceæ, their comparative anatomy; s search.)
[The fossil Psaronieæ belong undoubtedly to the Marattiales, but approach Cyatheaceæ, thus strengthening the view that the Le sporangiate Ferns originated from the Eusporangiate.]
Denkschr. K. Akad. Wiss. Wien, lxxviii. (1905) pp. 165–201 (3

RUMPF, G.—**Rhizodermis, Hypodermis, und Endodermis der Farnwurzel.** rhizodermis, hypodermis, and endodermis of Fern-rhizoids.)
[Structure of these tissues compared with those of angiosperms.]
Biblioth. Bot., heft 62 (1904) 48 pp.,

SCHNEIDER, G.—**Choice Ferns for Amateurs, their Culture and Manageme the Open and under Glass.**
[Abridged from the "Book of Choice Ferns."]
London: 8vo (1905) 338 pp., illust

SCHUMANN, K., UND LAUTERBACH, K.—**Nachträge zur Flora der Deut Schützgebiete in der Südsee (mit Auschluss Samoas und der Karolinen).** (Su ment to the flora of the German Protectorate in the South Seas, excl Samoa and the Carolines.)
[Contains 81 Pteridophyta, 9 of which are new, determined by Christ.
Leipzig: Bornträger, 1905,

SCOTT, D. H.—**On the Structure and Affinities of Fossil Plants. V. On a Type of Sphenophyllaceous Cone (Sphenophyllum fertile) the Lower Coal Measures.**
Phil. Trans, ser. B, No. 198 (1905) pp. 17–39 (

" " **The Early History of Seed-bearing Plants, as recorded in th boniferous Flora.**
[A summary of researches on Cycadofilices, etc.]
Mem. Proc. Manchester Lit. Phil xlix. 3 (1905) 32 pp.

" " **The Sporangia of Stauropteris Oldhamia Binney.**
New Phytologist, iv. (1905) pp. 114–20 (

SEWARD, A. C.—**Permo-carboniferous Plants from Kashmir.**
Mem. Geol. Surv. India, ii. 2 (1905) pp. 1–14 (

SHIBATA, K.—**On the Chemotaxis of Spermatozoids of Salvinia.**
[Japanese.] *Bot. Mag. Tokyo*, xix. (1905)

" " **Studien ueber Chemotaxis der Isoetes-Spermatozoiden.** (Stu the chemotaxis of the spermatozoids of *Isoetes*.)
[Effect of malic and other acids.]
Pringsh. Jahrb. Wiss. Bot., xli. (1905) pp. 56

" " **Studien über die Chemotaxis der Salvinia-Spermatozoiden. Vo Mitteilung.** (Studies on the chemotaxis of the sperma of *Salvinia*. Preliminary communication.)
Bot. Mag. Tokyo, xix. (1905) pp.

" " **Ueber die Chemotaxis der Spermatozoiden von Equisetum. Vo Mitteilung.** (On the chemotaxis of the spermatoz *Equisetum*. Preliminary notice.) *Tom. cit.*, pp.

SMITH, B.—**A Lepidodendroid Stem.** *Geol. Mag.*, ii. (1905) pp.

SMITH, J. D.—**Enumeratio Plantarum Guatemalensium, necnon Salvador Hondurensium, Nicaraguensium, Costaricensium.** (Enumeration of pl Guatemala, also of Salvador, Honduras, Nicaragua, Costarica.)
[Reprint of localised labels, including names of 91 Pteridophytes.]
Oquawkae (Ill.): Patterson, 1905, vii. an

SQUINABOL, S.—I pseudofossili dei gneiss e dei micascisti. Storia di un errore paleontologico. (Pseudofossils of gneiss and mica-schist. History of a palæontological error.)
[Sismonda's *Equisetum* from the Brianza is shown to be a *Coprinus*.]
Atti d. R. Accad. Sci. Padova, xx. 1 (1904) pp. 33–8 (1 pl.).

STEVENS, W. C.—Spore Formation in Botrychium virginianum.
Ann. of Bot., xix. (1905) pp. 465–74 (3 pls.).

STOCKFLETH, G.—Zur Ausrottung der Schachtelhalme. (On the extermination of *Equisetum*.) *Ill. Landw. Zeitung*, xxv. (1905) pp. 99–100.

TANSLEY, A. G. & R. B. J. LULHAM.—A Study of the Vascular System of Matonia pectinata. *Ann. of Bot.*, xix. (1905) pp. 475–519 (3 pls.).

THOMAS, E. N.—Some Points in the Anatomy of Acrostichum aureum.
[The relationship of the peculiar structure of the roots to the habitat of the plant, in salt swamps, is brought out, and the anatomy is compared with that of the fossil Lycopods.]
New Phytologist, iv. (1905) pp. 175–189 (2 pls.).

TIDESTROM, I.—Note on Botrychium virginianum (L.) Sw.
[With photograph of a specimen bearing a forked sporophyll.]
Torreya, v. (1905) pp. 160–2 (fig.).

„ „ **Notes on the Gray Polypody.**
[*Polypodium incanum* Sw., re-named *Marginaria polypodioides*, and its history and distribution described.
Tom. cit., pp. 171–5 (fig.).

TROTTER, A.—Osservazioni ed aggiunte alla flora irpina. (Observations on and additions to the flora of the Province of Avellino.)
Bull. Soc. Bot. Ital., 1905, pp. 20–31.

TURNER, F.—Botany of North-western New South Wales.
[Contains a list of 33 Pteridophytes, with a few remarks on their distribution.]
Proc. Linn. Soc. N.S.W., xxx. (1905) pp. 32–90.

UNDERWOOD, L. M.—The Early Writers on Ferns and their Collections I.–IV.
Contrib. Dept. Bot. Columb. Univ., No. 214 (1905).

VELENOVSKÝ, J.—Vergleichende Morphologie der Pflanzen. (Comparative Anatomy of Plants.)
[Part I., containing chapters on Pteridophyta.]
Prag: Rivnáč, 1905, 8vo, 277 pp., 200 figs., 2 pls.

WARD, L. F.—The Pteridospermaphyta. *Science* (n.s.) xx. (1904) pp. 25–26.

WASSNER, L.—Flora von Niederbayern (mit Ausschluss des Juragebietes). (Flora of Lower Bavaria, exclusive of the Jura district.)
[Contains Pteridophytes.] *Ber. Nat. Ver. Passau*, 1901–4 (1905) xlviii. and 167 pp.

WISTRÖM, P. W.—Bidrag till Dalarnes Flora. (Contribution to the flora of Dalecarlia.)
[List containing 13 Pteridophytes.] *Bot. Notiser*, 1905, pp. 283–96.

WORSDELL, W. C.—The Principles of Morphology.
[Largely concerned with the evolution of the Pteridophyta.]
New Phytologist, iv. (1905) pp. 124–33, 163–70.

ZALESSKY, M.—Pflanzenreste aus dem unteren Carbon des Msta Bassins. (Plant-remains out of the Carboniferous of the Msta Basin.)
Petrop. min. Jahrb., xlii. (1905) pp. 315–42;
Bot. Zeit., lxiii. (1905) p. 288.

ZEILLER, R.—Sur les plantes rhétiennes de la Perse recueillies par M. J. de Morgan. (On the Rhætic plants of Persia, collected by J. de Morgan.)
[Includes some fossil ferns.]
Bull. Soc. Géol. de France, v. (1905) pp. 190–7.

Bryophyta.

(By A. Gepp.)

New Families of Mosses.*—M. Fleischer publishes descriptioı two new families of mosses—Pterobryaceæ and Trachypodaceæ; t new genera—*Pterobryopsis*, *Müllerobryum*, and *Trachypodopsis*; a new species. Pterobryaceæ contains three sub-families—Œdicla(Pterobryeæ, and Garovaglieæ, and is allied to Leucodontaceæ. Tra podaceæ forms a rather isolated group, though formerly ranked u *Papillaria*. *Pterobryopsis* consists of two groups—*Eupterobry(* containing five species, and *Pterobryodendron*, containing twent) species, which mostly had been placed in *Garovaglia*. *Müllerobı* contains one species, which grows in Queensland.

New Malayan Mosses.†—M. Fleischer publishes descriptions c novelties issued in the seventh series of his "Musci Archipelagi I Exsiccati" (1904). These include two new genera—*Aerobryopsi* *Macrothamnium*, and several new species and varieties. *Aerobry* contains ten species, gleaned from *Aerobryum*, *Eriocladium*, *Meteo* etc., and, apart from its vegetative differences, is characterised very long papillose seta and sparsely hairy calyptra. *Macrotham* consists of five species taken from *Microthamnium*, and characteris their large and well developed sporogonia. *Floribundaria* of C. M is confirmed as a valid genus on account of its Leskioid peristome differing from the Neckeroid peristome of *Papillaria*, of which ge once formed a section.

Mosses of Formosa.‡—J. Cardot publishes the first ad(account of the mosses of the island of Formosa. Hitherto no than seven species were known; the list is now raised to 130 speci of which are new to science, but are not all likely to prove endeı the island. The specimens were collected by the Abbé Faurie in at a few places on the coast and on a low mountain. The rest (island and a high chain of mountains, well watered and timbered yet to be explored, and will probably yield as many more species. character of the moss-flora is mixed; 34 of the species are of Ja type, and 7 are Chinese, finding their southern limit in Formo(are Malayan; 18 occur in Ceylon, and 7 in Europe. Critical no appended to most of the species. The new species are figured.

Moss-Distribution in Baden.§—T. Herzog, having complet(systematic and descriptive part of his bryogeographic sketch moss-flora of Baden, passes on to discuss the distribution of all t species according to (1) zones of altitude, (2) nature of substratun 292 species inhabit the plains, 336 the hills, 360 the mountains, a the sub-alpine region; and numerous further statistics are adde(As to substratum and environment, the author gives lists of speci

* Hedwigia, xlv. (1905) pp. 53–64.
† Op. cit., xliv. (1905) pp. 301–29 (figs.).
‡ Beih. Bot. Centralbl. xix. 1 (1905) pp. 85–148 (figs.).
§ Bull. Herb. Boissier, v. (1905) pp. 851–4, 1028–44, 1171–86.

according to whether they seek or avoid shade or moisture, whether they grow on rocks, stones, earth, sand, in streams, on cultivated ground, damp meadows, ditches, bogs, forests, rotten wood, living trees, etc., and secondly, whether they prefer chalk or silica. He then gives a chapter on moss-formations, with topographical sketches. Taking the Black Forest, he discusses in turn the species characteristic of the mountain forest, the high moor, the sub-alpine rock region and streams, the rocky gorges of the forest, etc.

Flora exsiccata bavarica.* — The Royal Botanical Society of Regensburg in Bavaria have issued a dried moss flora of Bavaria consisting of 400 specimens in 16 fascicles of 25 specimens each. Four fascicles appeared in each of the years 1901–1904. The work includes mosses, Sphagnaceæ, and hepatics, among them being duplicates from the herbaria of P. G. Lorentz and L. Molendo in the Munich State Herbarium. Assistance in preparation has been given by leading specialists.

Hygroscopic Properties of Mosses.†—A. Cserey has experimented on the water-retaining powers of mosses, employing such common species as *Hypnum cupressiforme*, *H. purum*, *H. Schreberi*, *Hylocomium loreum*, *H. splendens*, *H. triquetrum*, *Anomodon viticulosus*, *Dicranum scoparium*, *Polytrichum formosum*, and *Sphagnum acutifolium*. He found that they absorb six times their own weight of water in less than a minute, and require seven days to give it all up again. Hence they play an important part in storing up on mountain slopes the excessive rainfall which, in rushing away all at once, would work destruction; and also, by slow evaporation, they affect the humidity of the air.

Biology of Polytrichaceæ.‡ — F. Quelle describes some of his observations on this subject. (1) The habit of the leaves forms two types. On the one hand, *P. piliferum*, *P. juniperinum*, and *P. strictum* have their leaf-margins so rolled inwards and connivent that the foliar lamellæ are exposed to daylight through a narrow slit only; and the leaves are consequently whitish-green. On the other hand, *P. aloides*, *P. nanum*, *P. urnigerum*, *P. alpinum*, *P. formosum*, *P. gracile*, and *P. commune*, have the lamellæ freely exposed to daylight, the narrow leaf-margins when damp not being curved over the lamellæ, though incurved when dry. Too great evaporation is hindered by the obliquely longitudinal curvature of the lamellate lamina. (2) Kerner's view as to the closing mechanism of the capsule is incorrect. The peristome teeth are not hygroscopic and do not bend, nor does the epiphragm sink or rise in presence of moisture. The sporangium forms a sort of pepper-pot both in damp and dry air, and is often directed horizontally. (3) Though the inflorescence of *Catharinea undulata* is dioicous, yet if a proliferation of the antheridial receptacle grows out it forms archegonia at its apex.

* Karthaus Prüll (Regensburg): Dr. I. Familler, 1901–4, 16 Lief.; see also Hedwigia, xlv. (1905) p. 37.
† Növén. közlemények, iv. (1905) pp. 7–9.
‡ Mitt. thüring. bot. Vereins, xix. (1904) pp. 17–22.

Analytical Keys to the Hepatics.* — Ch. Lacouture publish series of synoptical tables exhibiting the leading characters of the tr genera and species of the hepatics of France. These tables are ap able to the majority of our own species, and as they are very cl arranged and illustrated with over 200 figures in the text, the d mination of species is much simplified.

AHLFVENGREN, F.—**Die Vegetationsverhältnisse der westpreussischen östlich der Weichsel, mit besonderer Berücksichtigung der Veränderun Flora durch Melioration.** (The conditions of vegetation on the west Pr moors east of the Weichsel, with special reference to the alteration of th through improvements.)
[Contains mosses.] *Schrift. Nat. Ges. Danzig*, xi. (1904) pp. 24

ALPERS, F.—**Friedrich Ehrhart. Mitteilungen aus seinem Leben und Schriften unter Benutzung von bislang nicht veröffentlichten Urkunden von Briefen Ehrharts und seiner Witwe.** (Fr. Ehrhart. Contribution cerning his life and writings, including documents long unpublished, a as letters from Ehrhart and his widow.)
[Including an index of Ehrhart's plant-names, mosses, etc.]
Leipzig: Engelman (1905) 452 pp., 3 por

BAUER, E.—**Musci europæi exsiccati. Schedæ nebst kritischen Bemerkung II. Serie.** (Labels of "Musci Europ. exsicc." with critical remarks on Ser
[Contains a key to the European species of Andreæa.]
SB. Deutsch. Nat. Med. Ver. Bohmen, "*Lotos*," 1905, pp. 2

BERKOVEC, A.—**Ueber die Regeneration bei den Lebermoosen.** (On regen in the liverworts.) *Bull. Internat. Acad. Sci. Bohême*, 1905, 19 pp

BESTEL, F., & C. AIGRET—**Compte-Rendu de l'herborisation générale des 4 Juillet, 1904, dans l'Ardenne française.** Report on the general botani cursion to the French Ardennes, July 2–4, 1904.)
[Contains mosses.] *Bull. Soc. Roy. Bot. Belgique*, xlii. 1 (1905) pp. 1

BORBAS, V. VON—**Planktontelep O-Buda vizeiben.** (A plankton-station O-Buda waters.)
[*Riccia fluitans*, not observed near Budapest for 30 years, has m appearance in the Lemna-Alga plankton floating on the Roman
Magyar Bot. Lapok, ii. (1903)

BÖRGESEN, F., & C. JENSEN—**Utoft Hedeplantage. En floristisk Under af et Stykke Hede i Vestjylland.** (Utoft heath-plantation. A floristic ex tion of a piece of heath in West Jutland.)
[Description of the various plant-associations with lists including 48 and 15 hepatics.] *Botan. Tidssk.*, xxvi. (1905) pp. 1

BOULY DE LESDAIN—**Liste des Muscinées recueillies dans les fortificat Bergues (Nord).** (List of Muscineæ gathered within the fortificati Bergues.) *Feuille Jeunes Nat.*, No. 416 (1905) pp

BRITTON, E. G.—**Bryological Notes. II.**
[*Pseudocryphæa*, a new genus, *P. flagellifera* = *Neckera domingen Dendroalsia*, a new generic name for *Neckera abietina* Hook., a other species. *Macouniella* Kindb. is sunk into *Antitrichia* Four species of *Erpodium* are described, and two of them are ne
Bull. Torrey Bot. Club, xxxii. (1905) pp

* Hépatiques de la France. Tableaux synoptiques. Paris: Klincksiec 4to, 78 pp., figs.

BROTHERUS, V. F.—**Contributions to the Bryological Flora of the Philippines.**
[List of 40 mosses gathered by E. D. Merrill and others. Six new species are described.]
Oefv. Finsk. Vet. Soc. Foerh., xlvii. (1905) No. 14, 12 pp.

„ „ **Engler & Prantl's Die Natürlichen Planzenfamilien. Musci.** (Engler & Prantl's Natural Orders of Plants. Mosses.)
[Continuation, *Rhacocarpus* to *Cyrtopus*.]
Leipzig: Engelmann, 1905, Lief. 223, pp. 721–68 (figs.)

„ „ **Pleurorthotrichum, eine neue Laubmoosgattung aus Chile.** (*Pleurorthotrichum*, a new genus of moss from Chile.)
[Nearly allied to *Orthotrichum*, but distinguished by having lateral perichætia with very long bracts, calyptra narrow and split on one side, leaves quinquefarious, laxly crisped when dry. *O. chilense* is the only species; it was collected by K. Reiche in 1904.]
Oefv. Finsk. Vet. Soc. Foerh., xlvii. (1905) No. 15, 4 pp., 1 pl.

BROWN, R. N. R., & OTHERS—**The Botany of Gough Island. II. Cryptogams (excluding Ferns and Unicellular Algæ).**
[Contains nine mosses and three hepatics, determined by C. H. Wright; one moss is new.]
Journ. Linn. Soc. (Bot.) xxxvii. (1905) pp. 263–7.

„ „ **The Botany of the Orkneys.**
[With a list of eight mosses, determined by C. H. Wright.]
Trans. Proc. Bot. Soc. Edinburgh, xxiii. (1905) pp. 101–10.

CAJANDER, A. K.—**Beiträge zur Kenntnis der Entwickelung der Europäischen Moore.** (Contributions to a knowledge of the development of the European moors.)
Fennia, xxii. No. 3, Helsingfors (1905) 6 pp.

CARDOT, J.—**Notice préliminaire sur les Mousses recueillies par l'Expédition antarctique suédoise.** (Preliminary notice on the mosses collected by the Swedish Antarctic Expedition.)
[List of 186 mosses from the Magellanic region; among them are 40 new species and 9 new varieties.]
Bull. Herb. Boissier, v. (1905) pp. 997–1011.

„ „ **Quelques mousses nouvelles pour la Flore Belge.** (Some mosses new to the Belgian flora.)
[*Grimmia lamellosa* C. M. is identical with *G. subsulcata* Limpr., and is the older name. A key to *Thuidium Philiberti* and its allied species is given; the records of these species needs close revision.]
Bull. Soc. Roy. Bot. Belgique, xlii. 1 (1905) pp. 8–13.

CASARES GIL, A.—**Nota briologica.** (Bryological note.)
[List of sixteen hepatics and twenty-two mosses new to Spain.]
Boletin R. Soc. Española Hist. Nat., v. (1905) pp. 175–80.

CHAMBERLAIN, E. B.—**Some Common Errors.**
[On incorrect determinations of mosses and the real meaning of "duplicate."]
Bryologist, viii. (1905) pp. 106–7.

COCKS, L. J.—**Notes on the Mosses and Hepatics collected during Excursion of Scottish Alpine Botanical Club in 1904.**
[Contains lists of the more noteworthy species—12 mosses and 35 hepatics, mostly from Mam Soul and Scour na Lappaich.]
Trans. Proc. Bot. Soc. Edinburgh, xxiii. (1905) pp. 60–62.

Corbière, L.—La Flore de la presqu'île du Cotentin. (The flora of the Cote peninsula.)
[Lists of mosses and hepatics.]
Cherbourg et la Cotentin. Congrès Assoc. franç. Avanc. 1905, pp. 1(

Cornet, A.—Contribution à la flore bryologique de Belgique. (Contributio the bryological flora of Belgium.)
Bull. Soc. Roy. Bot. Belgique, xlii. 1 (1905) pp. '

Culmann, P.—Quelques stations nouvelles pour la Suisse et la Savoie. (S new stations [for hepatics] in Switzerland and Savoy.)
Rev. Bryolog., xxxii. (1905) p.

Dismier, G.—Note sur le Webera annotina auct. (Note on the *Webera ann* of authors.)
[Gives its history, and adds a key, descriptions, and fi of the derivations split from it; he regards *W. e* Correns as a variety, and *W. proligera* and *bulbife* subspecies of it.] *Tom. cit.,* pp. 8

„ „ **Remarques sur les Didymodon rigidulus Hedw. et D. spad Limpr.** (Remarks on *D. rigidulus* and *D. spadiceus.*)
[Descriptions and geographical distribution.]
Bull. Soc. Bot. France, lii. (1905) pp. 1

Dobbin, F.—A Sphagnum Bog. *Amer. Bot.,* viii. (1905) pp.

Douin, I.—Les Cephalozia du bois de Dangeau. (The Cephalozias of the Da wood.)
[Detailed study of four species, with 19 figures.]
Bull. Soc. Bot. France, lii. (1905) pp. 244–64 (

Dusén, P.—Beiträge zur Bryologie der Magellansländer, von Westpatagonie Südchile. (Contributions to the bryology of the Magellan district, Patagonia, and South Chile.)
[Continuation: *Campylopus—Eucamptodon.*]
Arkiv f. Bot., iv. 13 (1905) 24 pp.,

Elenkin, A.—Notes bryologiques. (Bryological notes.)
[Writing in Russian, the author reviews papers by Grimme-Melsung spore-development in mosses, by Golenkin on mycorrhizoid bod *Marchantia,* by Brotherus on mosses of the Caucasus, and by Jäde on Transcaucasian mosses; he also gives his own observations o moss vegetation around Borjom, in the Caucasus, as seen in 1899.]
Bull. Jard. Impér. Bot. St. Pétersbourg, v. (1905) pp.

Geheeb, A.—Meine Erinnerungen an grosse Naturforscher. (My recollecti great naturalists.)
[K., W., and W. P. Schimper, C. G. Carus, and P. von Martius.]
1904, 44 pp.; see also *Rev. Bryolog.,* xxxii. (1905) p

Geinitz, E., & C. A. Weber—Ueber ein Moostorflager der postglacialen F seit am Seestrande der Rostocker Heide. (On a peat-moss layer of the glacial coniferous age on the sea-shore of the Rostock heath.)
Arch. Ver. Freunde Naturg. Mecklenburg, lviii. 2 (1904) pp.

Gepp, A. & E. S.—Some Cryptogams from Christmas Island.
[Contains a list of fifteen mosses and one hepatic, collected by Ridley. Twelve of the mosses are new to this island of the Ocean, and one of them is new to science.]
Journ. of Bot., xliii. (1905) pp. 8

Gillot, X.—Notes botaniques: appendice à l'Histoire Naturelle de la Tuni M. H. de Chaignon. Mousses. (Botanical notes: appendix to the n History of Tunis, by de Chaignon. Mosses.)
[List of ten mosses and one hepatic gathered at Aïn-Draham, and mined by F. Camus.] *Bull. Soc. Hist. Nat. Autun,* xvii. (1904) p
Rev. Bryolog., xxxii. (1905)

GLOWACKI, J.—**Beitrag zur Laubmoosflora von Gmünd in Kärnthen.** (Contribution to the moss-flora of Gmünd in Carinthia.
[Four new species described.] *Jahrb. Nat. Landes-Museums Kärnthen*, xliii. (1905) pp. 93–128.

GOLDSCHMIDT, M.—**Notizen zur Lebermoose-Flora des Rhöngebirges.** (Notes on the liverwort-flora of the Rhöngebirge.
Ber. Ver. Natk. Cassel, xlix. (1905) pp. 1–8.

GROUT, A. J.—**Mosses with a Hand-lens.**
[Second edition, revised, enlarged, and including the hepatics.]
New York: 1905, xvi. and 208 pp., 39 pls., figs.

GUINET, A.—**Récoltes sphagnologiques aux environs de Genève.** (Sphagna gathered in the neighbourhood of Geneva.)
Rev. Bryolog., xxxii. (1905) pp. 85–86.

GYÖRFFY, I.—**Bryologiai adatok a Magás-Tátra Flórájához.** (Bryological contributions to the flora of the Hohen Tatra.)
Magyar Bot. Lapok, iv. (1905) pp. 271–80 (1 pl.).

" " **Grimmia leucophæa Grev. var. latifolia Limpr.**
[An account of the anatomy of this plant.]
Hedwigia, xlv. (1905) pp. 16–21 (2 pl.).

HANDEL-MAZZETTI, & OTHERS.—**Beitrag zur Kenntnis der Flora von Westbosnien.** (Contribution to a knowledge of the flora of West Bosnia.)
[Contains lists of 31 mosses and 20 hepatics.]
Oesterr. Bot. Zeitschr., lv. (1905) pp. 376–8.

HAYNES, C. C.—**Telaranea nematodes longifolia M. A. Howe.**
[This form of *T. nematodes* Gottsche is shown to be less rare in the United States than had been supposed.]
Bryologist, viii. (1905) pp. 97–8.

HERZOG, T.—**Ein Beitrag zur Kenntnis der Laub- und Lebermoos-flora von Sardinien.** (A contribution to a knowledge of the mosses and hepatics of Sardinia.) *Ber. Zürich Bot. Ges.*, ix. (1905) pp. 41–67; *Anh. Ber. Schweiz. Bot. Ges.*, xv.

HILL, E. J.—**Encalypta procera Bruch.**
[On characters presented by a sterile plant as compared with *E. contorta*; on the plants with which it associates; and on its distribution in North America.] *Bryologist*, viii. (1905) pp. 107–10.

HILLIER, L.—**Note préliminaire sur les Hépatiques des environs de Besançon.** (Preliminary note on the hepatics of the neighbourhood of Besançon.)
Bull. Soc. Hist. Nat. Besançon (1905) 16 pp.

HINTZE, F.—**Beiträge zur Moosflora von Pommern.** (Contributions to the moss-flora of Pomerania.)
[Calls attention to the more interesting species to be found in certain localities.] *Allg. Bot. Zeitschr.*, xi. (1905) pp. 151–4.

HOLZINGER, J. M.—**A Note on Local Moss Distribution.**
[On certain species which occur respectively on the arid tops and at the moist bases of the bluffs that stretch along the upper Mississippi.]
Bryologist, viii. (1905) pp. 112–13.

HUNTER, J.—**Dicranodontium longirostre at Holywood.**
[An uncommon species found in Co. Down.]
Irish Naturalist, xiv. (1905) p. 222.

HUSNOT, T.—**Nécrologie; L'Abbé Boulay; A. Le Grand; H. de Poli.**
[Obituary notices of these botanists.]
Rev. Bryolog., xxxii. (1905) pp. 114–15.

INGHAM, W.—**Mosses and Hepatics near Leyburn.**
[Short lists of species gathered in Wensleydale, the rarest being *Pedinophyllum interruptum* var. *pyrenaicum*, once previously found in Yorkshire.]
Naturalist, No. 585 (1905) pp. 299–300.

INGHAM, W.—**Mosses and Hepatics of Askrigg and District.**
[Lists of the more rare species gathered at Askrigg, Whitfi Gill, Semmerwater, etc., by the Yorkshire Naturali Union, confirming many of the records made by R. Bai some years ago.] *Naturalist*, No. 584 (1905) pp. 278-

" " **New and Rare Hepatics and Mosses from Yorkshire and Durham**
[Describes and figures *Kantia trichomanis* var. *aquatica*, a variety, remarkable for its blue-green colour, longly current leaf-base, and deeply cleft ovate stipules. G distribution and main characters of *Marsupella Pears* and notes on five other hepatics and two mosses. Descr a curious forking of the pellucid apical cell of the nerve in three several gatherings of *Barbula convoluta sardoa.*] *Naturalist*, No. 581 (1905) pp. 171–4 (fi

JAAP, O.—**Ein Kleiner Beitrag zur Moosflora des Thüringer Waldes.** (A si contribution to the moss-flora of the Thuringian Forest.)
Allg. Bot. Zeitschr., xi. (1905) pp. 106–8, 1:

" " **Weitere Beiträge zur Moosflora der Nordfriesischen Inseln.** (Fu contributions to the moss-flora of the North Friesland islands.)
Schr. Nat. Ver. Schleswig-Holstein, xiii. (1905) pp. 6

LANG, W. H.—**On the Morphology of Cyathodium.**
[Describes the structure and development of *C. fœtidissimum* and *C. c narum*. In structure of thallus and antheridium, and in develop of sporogonium, the genus is closely related to *Targionia*. *Cyatho* reveals itself to be a reduced Marchantiaceous form.]
Ann. of Bot., xix. (1905) pp. 411–26 (2

LETT, H. W.—**Notes on some Hepatics of Ulster.**
[Of the species recorded a century ago in Templeton's MS., 13 have regarded with suspicion; Lett has rediscovered eight of these amplifies Templeton's notes about them. He adds notes on 34 species found by himself in Ulster, in which province they are ra had been overlooked.] *Irish Naturalist*, xiv. (1905) pp. 1

LEVIER, E.—**Muscinee rare e nuove, raccolte in Sardegna dal Dott. Th. H** (New and rare Muscineæ, collected in Sardinia by Th. Herzog.)
[Contains descriptions of three new mosses, and notes on the distributi the mosses and hepatics in the island.]
Bull. Soc. Bot. Ital., 1905, pp. 2

LEWIS, J. F.—**The Plant Remains in the Scottish Peat Mosses. Part I Scottish Southern Uplands.**
Trans. Roy. Soc. Edinburgh, xli. (1905) pp. 699–723 (6

LOITLESBERGER, K.—**Zur Moosflora der Oesterreichischen Küstenländer.** the moss-flora of the coast-lands of Austria.)
[List of 109 hepatics; a supplement to Sendtner's list published in *Aplosia Schiffneri* is new.]
Verh. k.k. zool. bot. Ges., lv. (1905) pp. 4

MACVICAR, S. M.—**Census Catalogue of British Hepatics.**
[Compiled for the British Moss Exchange Club; comprises 70 gene 249 species, classified after Schiffner's scheme. Distribution acc to vice-counties, which are 112 in Great Britain and 40 in Ireland. alogue obtainable from Mr. Ingham, 52 Haxby Road, York.]
York: 1905,

MAGGI, L.—**Gli occhi di alcuni Muschi.** (The gemmæ of some mosses.)
Varietas, Milano, 1904, pp. 252–4; s
Hedwigia, xliv. (1905)

MANSION, A.—**Compte-rendu de l'excursion bryologique du 16 Octobre 1 Pécrot et à Florival.** (Report on the bryological excur Pécrot and Florival on Oct. 16, 1904.)
Bull. Soc. Roy. Bot. Belgique, xlii. 1 (1905) pp. 1

MANSION, A.—**Notes sur le Platygyrium repens Br. Eur. et le Fontinalis dalecarlica Br. Eur., espèces nouvelles pour la flore belge.** (Notes on these species new to the Belgian flora.)
Tom. cit., pp. 105–10.

" " **Note sur deux variétés remarquables de Muscinées nouvelles pour la Belgique: Hypnum molluscum Hedw. var. squarrulosum Boul. et Plagiothecium denticulatum B. S. var. aptychus Spruce.** (Note on two remarkable varieties of mosses new to the Belgian flora.) *Tom. cit.*, pp. 99–101.

" " **Notes sur les Pterigoneurum lamellatum Jur., Liochlæna lanceolata Nees, Fossombronia cæspitiformis De Not., Breutelia arcuata Schimp., Dicranum Blyttii Br. Eur., espèces nouvelles pour la flore belge.** (Notes on these species new to the Belgian flora.)
Tom. cit., pp. 61–71.

" " **Bilan de l'année bryologique belge.** (Balance sheet of Belgian bryology for the year. *Tom. cit.*, pp. 24–37.)

" " **Flore des Hépatiques de Belgique.** (Flora of the Belgian hepatics. [First instalment, describing all the thalloid species.]
Tom. cit., pp. 44–112.

" " & CH. SLADDEN—**Notes sur le Grimmia Doniana Sm. et le Bryum obconicum Hornsch., espèces nouvelles pour la Belgique.** (Notes on these species new to the Belgian flora.)
Tom. cit., pp. 101–5.

" " " " **Note sur le Jungermannia cordifolia Hook., espèce nouvelle pour la flore belge.** (Note on *J. cordifolia*, a species new to the Belgian flora.) *Tom. cit.*, pp. 59, 60.

MARCHAL, E.—**Sur la reproduction asexuelle et la régénération chez certaines Jungermanniacées.** (On asexual reproduction and regeneration in certain Jungermanniaceæ.) *Tom. cit.*, pp. 7, 8.

MARTIN, A.—**Hépatiques récoltées à Balleroy et dans la forêt de Cérisy (Calvados).** (Hepatics collected at Balleroy and in the forest of Cérisy.)
Rev. Bryolog., xxxii. (1905) pp. 105–6.

MASSART, J.—**Les Muscinées du littoral belge.** (The Muscineæ of the Belgian coast.
Bull. Jard. Bot. État Bruxelles, i. No. 6 (1905) 15 pp.

" " Ditto. Ditto.
[The mosses of the sand dunes, their associations, distribution, and conditions of existence, etc.]
Bull. Soc. Roy. Bot. Belgique, xlii. 1 (1905) pp. 141–62.

MATOUSCHEK, F.—**Bryologisch-floristische Mitteilungen aus Niederoesterreich mit besonderer Berücksichtigung der Moosflora von Seitenstetten und Umgebung.** (Bryological floristic notes from Lower Austria, with special reference to the moss-flora of Seitenstetten and its environs.)
33 *Jahresb. k. k. Staatsgymn, Reichenberg*, 1905, pp. 3–36.

MEYLAN, CH.—**Note sur la variété scabrifolia Lindb. du Myurella julacea (Vill.) Br. Eur.** (Note on *M. julacea* var. *scabrifolia*.]
Rev. Bryolog., xxxii. (1905) p. 93.

MIANO, D.—**Anomalie di sviluppo dei ricettacoli femminili di Lunularia vulgaris Mich.** (Anomalies of development of the female receptacles of *Lunularia vulgaris*.)
[An account of variations observed in plants collected in Sicily.]
Malpighia, xix. (1905) pp. 311–15 (1 pl.).

MIYAKE, K.—**On the Centrosome of Hepaticæ.**
Bot. Mag. Tokyo, xix. (1905) pp. 98–101.

MOORE, A. C.—**Sporogenesis in Pallavicinia.**
Bot. Gazette, xl. (1905) pp. 81–96 (2 pls.).

Müller, K. (Frib.)—**Monographie der Lebermoosgattung Scapania Dum.** (Mo graph of *Scapania*, a genus of Hepaticæ.)
[Treats of all the 65 known species in 9 groups.]
Nov. Act. Leop.-Carol. Deutsch. Akad. Naturf. Ha lxxxiii. (1905) 312 pp., 52

Müller, K.—**Beiträge zur Chemie niederer Pflanzen. I. Die chemische Zusamm setzung der Zellmembranen bei verschiedenen Kryptogamen. II. Beitrag Kenntnis der ätherischen Öle bei Lebermoosen.** (Contributions to the chemi of the lower plants. I. The chemical composition of the cell-membrane various cryptogams. II. Contribution to a knowledge of the ethereal oil Liverworts.) *Inaug. Diss.* (Freiburg, 1905) 55 pp.; see also *Hoppe-Seyl Zeitschr. Physiol. Chemie*, xlv. (1905) pp. 265–

Nordenskjöld, O.—**Wissenschaftliche Ergebnisse der Schwedischen Expedi nach den Magellanländern 1895–1897.** (Scientific results of the Swedish pedition to the Magellan district.)
[Contains hepatics determined by Stephani.]
Stockholm: Norstedt, 1905, iii. 2, pp. 317–523 (11 p

Paris, E. G.—**Index bryologicus.** (Index of mosses.)
[Continuation: *Mnium—Rhaphidostegium*.]
Paris: Hermann, 2nd ed., ii. fasc. xvii.–xviii., pp. 265–
iii. fasc. xix.–xxi., pp. 1–

" " **Muscinées de l'Afrique occidentale Française.** (Muscineæ of Fre West Africa.)
[List of 18 species, 9 of which are described as new.]
Rev. Bryolog., xxxii. (1905) pp. 10

Paul, H.—**Beitrag zur Moosflora von Oberbayern.** (Contribution to the moss- of Upper Bavaria.)
Mitt. Bay. Bot. Ges. Erforsch. heim. Fl., 1905, pp. 45

Péters, A.—**Compte-rendu de l'excursion de la section bryologique le 15 Mai à Bauche et Dorinne.** (Report on the excursion of the bryological sectic Bauche and Dorinne, May 15, 1904.)
[Lists of Muscineæ.] *Bull. Soc. Roy. Bot. Belgique*, x (1905) pp.

Podpěra, J.—**Vysledky bryologického výzkumu Moravy za rok 1904–5.** (Re of bryological researches in Moravia in the year 1904–5.)
Jahrb. Natw. Klubs. Prossnitz, 1905, 8vo, 33
see also *Oesterr. Bot. Zeitschr.*, lv. (1905) p.

Potier de la Varde, R.—**Notes sur quelques muscinées des Côtes-du-** (Notes on some Muscineæ of Côtes-du-Nord.)
Bull. Soc. Sci. Nat. de l'O. de la Fr., v. (1905) pp.

Quelle, F.—**Beiträge zur Moosflora von Heiligenstadt in Thüringen.** (Cont tions to the moss-flora of Heiligenstadt, in Thuringia.)
Mitt. Thüring. Bot. Vereins, xix. (1904) pp. 1

Reeves, J.—**Liverworts.**
[Brief list of species collected at Scotton.]
Naturalist, No. 584 (1905) p.

Renauld, F., & J. Cardot—**Musci Costaricenses.** (Mosses of Costa Rica.)
[A list of 48 species collected by Pittier; se of them are described for the first tim
Bull. Soc. Roy. Bot. Bel xli. 1 (1905) pp. 1

" " " " **Musci exotici novi vel minus cogniti.** (E mosses, new or but little known.)
[Numerous descriptions of new specie varieties of mosses and hepatics fro rious localities—Madagascar, India, J Pacific, Central America, West tr Africa, etc. The hepatics are describ Stephani.] *Tom. cit.*, pp.

Bell, J.—**Dicranum viride Lindb. var. dentatum, eine interessante neue Moos-Varietät.** (An interesting new variety of moss.)
[A description of this moss, together with its woodland surroundings.]
Hedwigia, xlv. (1905) pp. 40–43.

Schiffner, V.—**Bryologische Fragmente.** (Bryological notes.)
[xxiii. Some hepatics, especially *Cephaloziella*, new to the French flora. xxiv. On *Jungermannia minuta* 1 β *procera* N. ab. E. xxv. Some remarks on *Cephaloziella papillosa* (Douin) Schiffn., and its occurrence in Bohemia. xxvi. On the occurrence of *Riccia Crozalsii* Lev. in Italy.]
Oesterr. Bot. Zeitschr., lv. (1905) pp. 289–95.

" " **Ergebnisse der bryologischen Exkursionen in Nordböhmen und im Riesengebirge im Sommer 1904.** (Results of the bryological excursions in North Bohemia and in the Riesengebirge during the summer of 1904.)
[Annotated lists of mosses and hepatics.]
SB. Deutsch. Naturw.-med. Verein. "*Lotos*," *Prag.* xxv. (1905) pp. 12–53.

" " **Kritische Bemerkungen über die europaischen Lebermoose mit Bezug auf die Exemplare des Exsiccatenwerkes Hepaticæ Europeæ exsiccatæ.** (Critical remarks on the European hepatics, with reference to the specimens of the published set "Hepaticæ Europeæ exsiccatæ.")
Tom. cit., pp. 109–70.

Schumann, K., und Lauterbach, K.—**Nachträge zur Flora der Deutschen Schutzgebiete in der Südsee.** (Supplement to the flora of the German Protectorates in the South Seas.)
[Contains 16 hepatics and 9 mosses.]
Leipzig: Bornträger, 1905, 68 pp.

Stephani, F.—**Species Hepaticarum.**
[Continuation. Descriptions of new species of *Plagiochila* (end), *Tylimanthus*, *Leioscyphus*.] *Bull. Herb. Boissier*, v. (1905) pp. 736–51, 885–900, 917–46, 1129–44.

Thériot, I.—**Additions et Corrections à la flore bryologique de la Sarthe.** (Additions to and corrections of the moss-flora of the Sarthe.)
[Among other changes *Thuidium recognitum* is struck out, its specimens being referred to *T. Philiberti* mostly, and a few to *T. delicatulum*.]
Bull. Acad. Int. Géogr. Bot., xiv. (1905) pp. 180–2.

Torka, V.—**Zur Moosflora der Provinz Posen.** (On the moss-flora of the Posen province.) *Zeitschr. Nat. Abt. Deutsch. Ges. Posen Bot.*, xii. (1905) pp. 1–13.

Ihde, H.—**Notes on the Physiology of the Sporophyte of Funaria and of Mnium.**
Beih. Bot. Centralbl., xix. (1905) Abt. i., pp. 34–44.

Van den Broeck, H.—**Catalogue des plantes observées aux environs d'Anvers.** (Catalogue of plants observed in the neighbourhood of Antwerp.)
[Mosses and hepatics.]
Bull. Soc. Roy. Bot. Belgique, xlii. 1 (1905) pp. 13–22.

Velenovský, J.—**Vergleichende Morphologie der Pflanzen.** (Comparative morphology of Plants.)
[Part 1, containing chapters on Musci.]
Prag: Rivnáč, 1905, gr. 8vo, 277 pp. 200 figs, 2 pls.

Waddell, C. H.—**Thuidium delicatulum Mitt. in Co. Dublin.** (A rare species found on sand-hills by the sea at Malahide in the spring of 1904, and twice previously found in Ireland.) *Irish Naturalist*, xiv. (1905) p. 133.

Warnstorf, C.—**Kryptogamenflora der Provinz Brandenburg. Laubmoose.** (Cryptogamic flora of the province of Brandenburg. Mosses.)
[Continuation. *Heterocladium—Plagiothecium.*]
Leipzig: Bornträger, 1905, Band ii. heft 4, pp. 673–832 (figs.).

WATTS, W. W., & T. WHITELEGGE—**Census Muscorum Australiensium.**
[A classified catalogue of the frondose mosses of Australia and Tasmani
Abstr. Proc. Linn. Soc. N.S. Wales (Sept. 30, 1905) 3

WOLCSÁNSKY, J.—**Adatok Magyarország lombos mohainak ismeretéhez.** (C
tributions to a knowledge of the mosses of Hungary.)
Növém. közlem. iv. (1905) pp. 28-

WORSDELL, W. C.—**The Principles of Morphology.**
[Discusses the Bryophytes as indicating stages in the evolution of higher plants.] *New Phytologist*, iv. (1905) pp. 124–33, 163

YOUNG, W.—**The Hepatics of the Glenshee District.**
[Adds 12 new records for E. Perthshire, 6 for Forfarshire, 5 for S. A deenshire, and 1 for Scotland—*Cephaloziella Jackii.* The pape the result of a week spent in collecting during July 1904, and con of a series of field-notes.]
Trans. Proc. Bot. Soc. Edinburgh, xxiii. (1905) pp. 93

ZODDA, G.—**Le Briofite del Messinese.** (Bryophytes of the Messina district.)
Atti Accad. Dafnica Acireale, i. (1905) 1

" " **Una gita alle isole Eolie.** (A trip to the Æolian Isla ds.)
[Contains mosses and hepatics.]
Atti Accad. Pelorit, xix. (1904) 38
See also *Hedwigia*, xliv. (1905) p.

Thallophyta.

Algæ.

(By E. S. GEPP.)

Morphology and Biology of Algæ.*—F. Oltmanns has brough the second volume of his great work on the Morphology and Biolog Algæ. This volume gives a general survey of the whole subject, the first volume dealt only with the systematic side of the group. author emphasises the fact that his views as to the relation of the va groups to each other are put forward as rather tentative than final. considers that all algæ originated from the protista, rising thr flagellata along different lines to true algæ; and he holds that sexu did not appear first in one group and spread from that to the rest o algæ, but that it appeared quite independently in various families. also thinks that in each large group development of oogamy has st from a rather poor isogamy. The main divisions into which the pr volume is divided are as follows: the system of algæ, the develop of the reproductive organs, the algal cell, nutrition of algæ, condi of life, periods of vegetation, stimulation, polymorphism, alternati generations, adaptation, apparatus and methods of work, inde authors, index of subjects. From these headings it will be seen th the ground is fairly covered, especially as the author has consulte latest papers on the various subjects. Under adaptation, all the forms of algæ are dealt with, bush-like, hollow and swollen, whip net-like, etc., dorsiventral, cushion-shaped, and encrusted forms phytes, endophytes, and parasites, plankton, aerial forms, and s symbiotic both with other plants and with animals. The book is

* Jena: Gustav Fischer, 1905, vi. and 443 pp. 150 figs. in text, 3 genea tables.

illustrated, and references to literature are given at the end of each section.

Phycological Notes of the late Isaac Holden.*—F. S. Collins has undertaken to edit the valuable notes of Holden, with whom and Setchell he was associated in the issue of the "Phycotheca Boreali-Americana." Holden was an indefatigable collector, and his notes will be most interesting to all algologists. In the publication of them, the record is not in chronological order, but by species; the marine and fresh-water forms from Connecticut localities being in separate lists. Under each species (or variety) are given the numbers, the localities, and the dates; and where specimens of the number in question were distributed in the "Phycotheca Boreali-Americana," they are indicated by the initials P.B.A., with the respective number. A list is also appended of species collected by him in Newfoundland.

Seaweeds.†—D. W. Bevan describes in very popular form the three groups of marine algæ, brown, red, and green. The commonest species are described, and some of them are figured. (It may be worth remarking that fig. 6 on p. 202 is wrongly named *Laminaria digitata*. It represents a plant of *L. Cloustoni*). The author gives useful hints to would-be collectors as to the best way of drying and mounting specimens, and he also describes the escape of zoospores in *Cladophora rupestris*, and the best method of showing their heliotropic tendency.

Effect of Bora on Marine Algæ.‡—C. Techet describes the extraordinary effect of a strong north wind (the Bora) on the shores of Istria and especially at Trieste in the early part of 1905. The algal vegetation which was not adequately submerged was either injured or destroyed. *Dictyota dichotoma* disappeared almost entirely, and many algæ, *Callithamnion*, *Chylocladia*, *Cystosira abrotanifolia*, *Ulva*, and *Bryopsis* were partly destroyed. In their places there appeared after a short time a number of Bacillarieæ, such as had never been observed before, and three months later they were still there. They consisted chiefly of species of *Navicula*, a genus which lives well in low temperature. The sea at the time was scarcely 40° F. near the surface.

Method of Drying Algæ speedily.§—J. Chalon describes a practical way of overcoming the difficulties of drying marine algæ, when travelling. He carries with him on his travels a plate of red copper, curved, 1½ mm. thick. The other dimensions are 30 and 35 cm. This is placed on one of the common petroleum stoves found in all households abroad. On one side lies the heap of drying papers with algæ in process of being pressed, and each sheet is by turn placed on the hot copper plate over the stove, the algæ being meanwhile removed and replaced when the sheet is dry. The dry sheets form by degrees a heap on the other side of the stove, and in a short time all the algæ are once more being pressed between quite dry papers. This arrangement saves

* Rhodora, vii. (1905) pp. 168–72, 222–43.
† Knowledge and Sci. News, ii. (1905) pp. 202–3, 225–6, 248–9 (23 figs. in text).
‡ Oesterr. bot. Zeitschr., lv. (1905) pp. 238–9.
§ Bull. Soc. Roy. Bot. Belgique, xlii. (1904–5) p. 95.

time and trouble, and specimens which might be ruined by mould ; dried in safety.

Algæ at the Caen Herbarium.*—J. Chalon gives some importi information regarding the herbaria preserved at the Faculté des Scien at Caen, where he has been working recently. Each collection is k separate, and a catalogue is being prepared which will enable a student find at once any species he may desire to see in any of the separate herba The collections of marine algæ by Lenormand, Brébisson, Lamouro Chauvin, and Vieillard are to be found at Caen, and all facilities study are given by the courteous keeper of the institution, Profe Lignier.

Cyanophyceæ.†—F. Brand publishes remarks on some doubtful po connected with Cyanophyceæ. The first of these treats of the so-ca gas vacuoles, and the author gives an historical account of the work views of other writers. He confirms his own former conclusi namely, that even the Cyanophyceæ which form the "water bloom" not contain red bodies at all times; and that in *Anabæna flos-aquæ* formation of these bodies is preceded by an extraordinary conditio the cell contents. The second note deals with various apical among Cyanophyceæ, and adds to our knowledge on the subject. third gives information as to the quick staining of Cyanophyceæ, wl has been treated of by the author in a previous paper.

Fresh-water Algæ from the Orkneys and Shetlands.‡—W. G. S. West visited these islands in August 1903 for the purpos studying the fresh-water algæ. They record 447 species, of which 5 new, as well as some varieties. Comparisons are drawn between fresh-water algæ of these islands and those of the Faeröes and Icel as enumerated by Börgesen. Out of 174 Desmids recorded from Faeröes, 118 occur in the Orkneys and Shetlands; and out of 58 sp of Desmids known from Iceland 50 have now been found in the Ork and Shetlands. The fresh-water plankton was not very rich, and th attributed by the authors to the wetness of the season and the shal ness of the lochs examined. A table of comparison shows the occurr of the species of phytoplankton in the Orkneys, Shetlands, and Fae In the general systematic account of the collections the authors re the localities where each species was found, and occasionally add n Two plates show the new or rare forms.

Diatoms.§—H. H. Gran publishes a work on the plankton of northern seas, which includes all species hitherto recorded nort 50° N. Lat., as well as a few tropical forms, which may possibl found in those seas. A short description is given of the struc reproduction, occurrence and distribution of diatoms in general instructions are given as to their preparation and examination. author regards the pelagic forms as being the typical representativ marine plankton. As regards the fresh-water and littoral forms, s

* Bull. Soc. Roy. Bot. Belgique, xlii. (1904–5) pp. 96, 97.
† Hedwigia, xlv. (1905) pp. 1–15.
‡ Trans. and Proc. Bot. Soc. Edinburgh, xxiii. (1905) pp. 3–41 (2 pls.)
§ Nordisches Plankton. Kiel: Brandt, theil xix. (1905) 146 pp. 178 figs.

as they have hitherto been observed as chance constituents of marine plankton, they are mentioned only, together with a note of the locality and a reference to the best description and a plate of each species in literature. A key is drawn up for those genera which are fully treated, and these include altogether 175 species. To each species is appended a list of synonymy, references to literature, a description, and a short note of the distribution. All but 3 species are figured, and most of them are shown in several positions; 18 of these figures of species in different positions are new, and 36 species are represented by new drawings; and 3 new forms of existing species are described.

Diatoms of the Trentino.*—V. Largaiolli gives a short report on the diatoms found by him in the river Noce, which rises in the Ortler group and flows into the Adige. The author has taken samples from the river at three points, near its source, about half-way along its course, and near the mouth. Forty-five species and varieties are recorded, of which one form is new for the Trentino district, while 7 of them are rare. The first sample is characterised by the presence of *Ceratoneis Arcus*, and the second by the preponderance of *Cymbellæ*. A table of the species is given, with their distribution in Trentino.

Fossil Diatoms.†—J. Pantocsek has studied the fossil diatoms from deposits in Hungary and various other parts of the world. In a short paper he describes a new genus, *Szechenyia*, and 17 new species, and figures 68 of the species described in the paper. Another and larger contribution ‡ to our knowledge of fossil Bacillarieæ is published in the descriptions of the species figured in his tables 1–42 of the "Atlas der fossilen Bacillarien Ungarns." In the third part of that work 584 new or little known species were figured, and the text is now published separately. The diatoms there treated of include species from Bulgaria, Russia, Moravia, and Japan, as well as Hungary.

A New Genus of Plankton Algæ.§—W. Schmidle describes a new alga which he has found in a collection of plankton made by Lauterborn at Roxheim. The alga in question is very small, 5–8 μ long and about 2 μ broad. It forms a cœnobium consisting of two half-moon-shaped cells, placed as a rule crosswise. Reproduction occurs by cell-division, each cell dividing first across and then lengthwise. The cœnobium is formed by the two pairs of the longitudinal division. The alga forms the type of a new genus, *Didymogenes*, and is allied to *Actinastrum* Lag.

Protista Plankton.‖—This paper by E. Jörgensen deals with the marine plankton of the N.W. part of the coast of Norway, and is published in connection with the Hydrographical and Biological Investigations in Norwegian Fjords. The work is divided into three sections:

* Atti Accad. Sci. Ven. Trent.-Istr., ii. (1905) pp. 1–8.
† Verhandl. Ver. Nat. und Heilk. Presburg (1903) 18 pp., 2 pls.
‡ Beitr. Kenntn. Fossil. Bacillarien Ungarns. III. Pozsony (Presburg): Wigand, 1905, 118 pp.
§ Hedwigia, xlv. (1905) pp. 34–5.
‖ Bergens Museums Skrifter, 1905, pp. 49–113, 146–51 (2 pls.).

(1) Plankton tables; (2) General remarks on the plankton; (3) species found in plankton, and their distribution, and remarks o new or critical forms. In the first section the organisms found i plankton samples, which were collected in 1899 and 1900, are arr in tables in which the locality, the date of collecting, the deptl salinity, the temperature, and the more or less common occurrer the observed species, are given. In the second section the author with the question as to the origin of the large masses of diatoms occur in the spring. He criticises the views of Gran, and suggests explanations, which are too long to give here in detail. In the section many useful remarks are made on the definition of the s A key is published of the plankton forms of *Coscinodiscus*, and species is described. Critical remarks are made on Thalass Among the Peridineæ the author has worked out specially the *Peridinium* and *Ceratium*. The new and critical species are illu by three large plates.

Dictyotaceæ and Aglaozonia.*—C. Sauvageau publishes so teresting observations on three species of *Zonaria*, *Z. flava*, *Z. va* and *Z. lobata*, which he has studied at Teneriffe in a living stat describes their structure aud reproductive organs, and the results experiments with germinating spores. Finally, he describes species of *Aglaozonia*, *A. canariensis*, which is in appearance ver like *Zonaria variegata*. It also resembles a *Zonaria* in structure, its reproductive apparatus. The sporangia of *A. canariensis* numerous, and are scattered and pyriform, like the *Zonaria* mentioned above; and in these points *A. canariensis* shows an to *Zonaria* and the Dictyotaceæ, which is not found in so m degree in the other species of *Aglaozonia*. In pointing out this the author does not dispute the view that Dictyotaceæ and Cut are quite distinct from one another; but he does dispute the va the group Cyclosporeæ, arguing that the presence of a vol non-motile oosphere does not suffice to warrant the placing of taceæ and Fucaceæ in the same group. He regards these tw as extreme developments of two divergent series arising fro filamentous Phæosporeæ.

On the Colouring Matter in Phæophyceæ.†—M. Tswett the work of Molisch on this subject, and sums up his remarks as The pre-existence of phycophæin in living brown algæ, alth tremely unlikely, is not finally disproved by the experiments of The assumption that a special modification of chlorophyll (ph exists in the chromatophores of the brown algæ is not justifie colouring matter of *Fucus* consists of chlorophyllin *a*, chloro (Sorby's chlorofucin), carotin, and fucoxanthin. Molisch's l is identical with fucoxanthin.

Periodicity of the Sexual Cells in Dictyota dichotoma.‡— Williams has made a careful study of this interesting subject,

* Soc. Sci. Arcachon, viii. (1905) 16 pp.
† Bot. Zeit., lxiii. (1905) pp. 273–8.
‡ Ann. of Bot., xix. (1905) pp. 531-60 (6 diagrams in text).

kept systematic records of the details of variation from 1897 to the present time. He finds that the crops of sexual cells are initiated, matured, and discharged in the space of a fortnight, and that a general liberation of oospheres and antherozoids takes place on a certain day, sometimes two or three days immediately after the highest spring tide. Deviations from this rule occur, however, and the causes of such deviations are discussed in the present paper. The author first proceeds to give a general description of the sexual plant. *D. dichotoma* is an annual, and the germling commences to elongate during May. Fruiting plants may be met with in June, but reproduction is not common till the end of July. During August and September periodicity is regular, and after that it slows down, and ceases towards the end of November. The antheridia and oogonia are, as stated above, produced in fortnightly crops which synchronise with the spring tides, and the development of the crops is determined by the time and height of these tides, progress being very slow during the neaps. The causes which produce this periodicity are variations in the degree of aeration and of pressure, and particularly differences of temperature and of illumination. The author has examined and watched the development of *D. dichotoma* both in the Menai Straits and at Plymouth, and he finds that the difference between the details of periodicity at these two places is due to the difference in the time of day at which low water of spring tides occurs at the two places. In the Menai Straits the time of lowest water falls in the hours of daylight during the summer months, while at Plymouth it occurs at midday and midnight. Thus at Plymouth the total amount of light obtained during spring tides is less, and the result is that the plants are poorer and the crops are several tides later in their development. Thus periodicity is seen to be affected by illumination, and since winds may affect the tide and cause a difference of level, they may also be regarded as factors in the question. The author finds that in herbarium specimens from the Southern hemisphere periodicity may be traced, but only in localities where there is an appreciable change of tide level. Finally, suggestions are made of the lines along which future work on the subject should be carried out.

ANDERSON, J. P.—**Decatur County Algæ.** *Iowa Nat.*, i. (1905) pp. 55–8.

ANONYMOUS—**Fresh-water Plankton.** (Continued.)
[Article in Japanese; names in Latin.]
Bot. Mag. Tokyo, xix. (1905) No. 220, pp. 66–9, 106–8.

BEYTELS, J.—**Die Kohlehydrate der Meeresalgen und daraus Hergestellte Erzeugnisse.** (The carbohydrates of marine algæ and their derivatives.)
Dissert. Hildesheim, 1905, 54 pp.

BORBAS, V. v.—**Planktontelep O-Buda vizeiben.** (A plankton station in the O-Buda waters.)
[The author finds free-floating *Lemna* plants chained together by filamentous algæ.] . *Magyar Bot. Lapok*, ii. (1903) p. 195.

CASU, A.—**Contribuzione allo studio della flora delle saline di Cagliari.** (Contribution to the study of the flora of the saltworks of Cagliari.)
[Mention is made of *Microcoleus chthonoplastes* Thur. studied by Cavara in 1902.] *Ann. de Bot.*, ii. (1905) pp. 403–33 (2 pls.)

CHALON, J.—**Note sur une forme très réduite du Fucus limitaneus Mont.** on a very reduced form of *F. limitaneus*.)

[The author has found this plant on the rocks of Andagorria, Cape Figuier, where it covers the surface for some distance. T are calcareous, in horizontal layers, and are washed by the tide day. He finds great uniformity in the size and aspect of t throughout the area, and is inclined to regard it as a species. Th is constant: 10–15 mm. The author further points out strikin resemblance between *F. platycarpus* and *F. vesiculosus*.]

Bull. Soc. Roy. Bot. Belgique, xlii. (1904–5)

CHASE, H. H.—**Flora of Michigan: Diatomaceæ.**

Fifth Ann. Rep. Michigan Acad., 1904, p

CUSHMAN, J. A.—**The Desmid Flora of Nantucket.**

[This sandy island has many well-lighted ponds, from which 50 l material were collected during spring, with the result that over 50 species is given, some being additions to the New Engla

Bull. Torrey Bot. Club, xxxii. (1905) p

DUTERTRE, E.—**Note sur un Schizomycète, Parasite des Diatomées.** (I Schizomycete, parasite of Diatoms.) *Microgr. Prép.*, xiii. (1905) p

ENTZ, G.—**Beiträge zur Kenntnis der Peridineen.** (Contributions to a k of Peridineæ.) *Math. Nat. Ber. Ungarn.*,

Leipzig, 1905, pp. 96-

ERNST, A.—**Die Assimilations- und Stoffwechsel produkte bei Derbesia-Ar** products of assimilation and metabolism in species of *Derbesia*.

Verh. Schweiz. Naturf. Ges. Winterthur, 1904 (1905)

FINK, B.—**Some Notes on certain Iowa Algæ.**

Proc. Iowa Acad. Sci., xii. (1905)

O.S.G.—**The Monsoon Dust of the South Atlantic Ocean.**

Plant World, viii. (1905) pp. 1

GAIDUKOV, N.—**Über die Eisenalge Conferva und die Eisenorganisme wassers im allgemeinen.** (On the iron alga *Conferva* and iron org fresh water in general.) *Ber. Deutsch. Bot. Ges.*, xxiii. (1905)

GEPP, A. & E. S.—**Some Cryptogams from Christmas Island.**

[This paper includes a list of 22 marine algæ, the first recorded island. One new species, *Halymenia polyclada*, is described.]

Journ. of Bot., xliii. (1905)

GILDERSLEEVE, N.—**Studies on the Bactericidal Action of Copper on in Water.** *Amer. Journ. Med. Sci.*, cxxix. (1905)

GOROSCHANKIN—**Beiträge zur Kenntniss der Morphologie und Syst Chlamydomonaden. III. Chlamydomonas coccifera Gorosch.** (Cont a knowledge of the morphology and systematic position of Chlamyd

Flora, xciv. (1905

GUILLIERMOND, A.—**Contribution à l'étude cytologique des Cyanophy** tribution to the cytological study of Cyanophyceæ.)

Comptes Rendus, cxli. (190

HÄNDEL-MAZZETTI, & OTHERS—**Beitrag zur Kenntniss der Flor Bosnien.** (Contribution to a knowledge of the flora of West Bosni

[Contains a list of 10 fresh-water algæ named by E. Lampa.]

Oesterr. Bot. Zeitschr., lv. (190

HEIMERL, A.—**Beitrag zur Flora des Eisaktales.** (Contribution to the Eisackthal.)

[Contains a list of 13 fresh-water algæ from the neighbourhood

Verh. k. k. Zool. Bot. Ges. Wien, lv. (1905

JACKSON, D. D.—**The Movements of Diatoms and other Microscopic Pl**

[These are said to be due to the impelling force of the bubbl evolved from the chlorophyll bands.]

Journ. R. Micr. Soc. London, v. (190

JONSSON, H.—**A contribution to the knowledge of the Marine Algæ of Jan Mayen.**
[A list of fifteen species collected by Kruuse in June 1900.]
Bot. Tidsskr., xxvi. (1905) pp. 319–20.

KRASKOVITS, G.—**Ein Beitrag zur Kenntniss der Zelltheilungsvorgänge bei Œdogonium.** (Contribution to a knowledge of the cell-division in *Œdogonium*.)
SB. k. k. Akad. Wiss. Wien Math.-nat. Kl., cxiv. (1905) pp. 237–74 (11 figs. in text, 3 tables).

KRAUSE, F.—**Das Phytoplankton des Drewenzsees in Ostpreussen.** (The phytoplankton of the Drewenz Lake in East Prussia.)
Arch. Hydrobiol. u. Plankton, i. (1905).

KUESTER, E.—**Ueber den Einfluss von Lösungen verschiedener Konzentration auf die Orientirungsbewegungen der chromatophoren.** (On the influence of solutions of different concentration on the polarity of chromatophores.)
Ber. Deutsch. Bot. Ges., xxiii. (1905) pp. 254–6.

LAING, R. M.—**Revised List of New Zealand Seaweeds. Appendix I.**
[The first addition to the author's previously published list. Two new species are described—*Ceramium Laingii* and *Bostrychia similis*.]
Trans. and Proc. N. Zeal. Inst. for 1904, xxxvii. (1905) pp. 380–4.

LEMMERMANN, E.—**Brandenburgische Algen. III. Neue formen.** (Brandenburg algæ. New forms.)
[Description of 3 new species and 2 varieties, with critical notes on other species.] *Plöner. Forsch. Ber.*, xii. (1905) pp. 145–53 (pl.).

LIVINGSTON, B. E.—**Physiological Properties of Bog-water.**
[Poisonous effect on *Stigeoclonium*.]
Bot. Gazette, xxxix. (1905) pp. 348–55 (fig.).

LÜTKEMÜLLER, J.—**Zur Kenntnis der Gattung Penium.** (Contributions to a knowledge of the genus *Penium*.)
Verh. k. k. Zool. Bot. Ges. Wien, lv. (1905) p. 332.

MANN, A.—**Diatoms, the Jewels of the Plant World.**
Smithsonian Misc. Coll., iii. (1905) pp. 50–8 (4 pls.).

MAZZA, A.—**Saggio di Algologia oceanica.** (An essay in the study of oceanic algæ.)
[A continuation of the work, which is intended to simplify for students the task of identifying marine algæ. Many interesting notes are appended to the species' names. The genus *Chantransia* is concluded, and *Nemalion*, *Helminthocladia*, and *Liagora* are dealt with.]
Nuov. Notar., xvi. (1905) pp. 129–41.

MIGULA, W.—**Thomé's Flora von Deutschland, Oesterreich und der Schweiz. Kryptogamen-Flora. Algen.** (Thome's flora of Germany, Austria, and Switzerland. Cryptogamic flora. Algæ.)
[Continuation. *Rivularia—Cocconeis*.]
Gera : Zezschwitz, 1905, lief. 23, 24, pp. 145–208 (10 pls.).

MOORE, G. T., & KELLERMAN, KARL F.—**Copper as an Algicide and Disinfectant in water supplies.**
[The authors have successfully treated over fifty reservoirs for the removal of algæ, and they find that much less copper is required to eradicate algæ from reservoirs than would be necessary to destroy algæ under laboratory conditions.] *U.S. Dep. Agric. Bureau Plant Industry*, Bulletin 76 (1905) 55 pp.

PAULSEN, O.—**On some Peridineæ and Plankton-Diatoms.**
[During the voyage of the 'Thor' to the Faeroës and Iceland in the summer of 1904, the author collected plankton. In giving his more important results, he describes and figures three new species of *Peridinium*, and discusses *P. Steinii* Jörgs. and *Chætoceras gracile* Schütt and *C. simplex* Ostf., giving new figures of them. The last-named species has the surprising but not unprecedented distribution—Caspian and Iceland.] *Med. Kommiss. f. Havundersög København Plankt.*, i. 3 (1905) 7 pp.

PETKOFF, ST.—**Troisième contribution à l'études algues d'eau douce de B** (Third contribution to the study of the fresh-water algæ of Bulgaria.) *Perioditch. Spissarné*, lxv. (1904) p. 32,

PRUDENT, P.—**Contribution à la flore diatomique des Lacs du Jura. VI. Bourget.** (Contribution to the diatom flora of the Jura Lakes. VI Bourget.) *Ann. Soc. Bot. Lyon*, xxx. (1905) pp. 17-24

RICHTER, O.—**Ueber Reinkulturen von Diatomeen.** (On pure cultures of di *SB. "Lotos," Prag*, xxiv. (1904)

SCHMIDT, A.—**Atlas der Diatomaceen-Kunde.** (Atlas of diatoms.) Leipzig: Reisland, parts 64–5, 8 pls., 8 pp. of explanato

SCHUMANN, K., & K. LAUTERBACH—**Nachträge zur Flora der Deutschen gebiete in der Südsee.** (Supplement to the flora of the German Prote in the South Seas.)
[Contains four Rhodophyceæ.] Leipzig: Borntraeger, 1905, xiv. and

SETCHELL, W. A.—**Algæ for Eating or Ceremonial Use of the Hawaiians.** *Univ. California Publications*, 190

" " **Gymnogongrus Torreyi.**
[This mysterious species is really a robust *Ahnfeltia plicata*.] *Rhodora*, vii. (1905) p

" " **Post-embryonal Stages of the Laminariaceæ.** *Univ. California Publications*, 1905, 14 p

SIMMONS, H. G.—**Ytterligare om Faeröarnes hafsalgvegetation och om gernas spridning.** (Additions to the marine flora of the Faeroës, and distribution of marine algæ.) *Bot. Notar.*, 1905, pp.

STEUR. A.—**Neuere Arbeiten ueber Plankton.** (Recent literature on plan *Verh. k. k. Zool. Bot. Ges. Wien.* lv. (1905) pp.

" " **Ueber das Kiemenfilter und die Nahrung adriatischer Fische.** gill-filter and the nutriment of fishes in the Adriatic.)
[Reference is made to diatoms, Peridineæ, and ot found in the stomach of fishes from the Adriatic.] *Tom. cit.*, p

TANSLEY, A. G., & F. E. FRITSCH—**The Flora of the Ceylon Littoral.** *New Phytologist*, iv. (1905) pp. 1-17, 27-55 (figs. 8

TOBLER, A.—**Die Karposporenbildung der Florideen.** (The formation spores in Florideæ.) *Naturw. Wschr.*, 1905, 6 p

WAGER, H.—**The present state of our knowledge of the Cytology of t phyceæ.** *Rep. Brit. Ass. Adv. Sci.*, 1904 (1905)

WETTSTEIN, R. VON—**Das Pflanzenleben des Meeres.** (Plant life of the *Schrift. Ver. Verbr. Naturw. Kenntn* xlv. (1905) 3 fig

YENDO, K.—**Preliminary List of Japanese Fucaceæ.**
[Article in Japanese; names in Latin.] *Bot. Mag. Tokyo*, xix. (1905) p

ZERNOV, S.—**Sur le changement annuel du plancton de la Mer Noire de Sébastopol.** (On the annual change of the plankton of the Black Bay of Sebastopol.) *Bull. Acad. Sci. St. Pétersbo* xx. (1904) p

Fungi.

(By A. Lorrain Smith, F.L.S.)

Study of Monoblepharideæ.*—M. Woronin had prepared before his death a series of drawings and notes on *Monoblepharis*. W. Franzschel has edited and published the paper. Woronin describes how he was led to search for the fungus on plant remains taken from a pond. These he kept under observation in clear water, and found growing on them numerous Phycomycetes and more or less developed plants of *Monoblepharis*. He selected *M. sphærica* for detailed description. It grew in tufts of non-septate filaments with rhizoids at the base. A septum was formed in the hyphæ just below the oosphere. In this species the antheridia were hypogynous. The fertile hyphæ produced several oogonia at the tips of branches, the branching being sympodial. In the antheridium 4–6 spermatozoids were formed, each with one long cilium. They escaped by a papilla, and either swam away or attached themselves to the oogonium, moving round the outside till the apex was reached. The wall of the oogonium was then dissolved, and fusion took place between the two sexual bodies. The resulting zygote developed inside the oogonium, or it passed out through the opening at the top. When mature it is yellowish-brown in colour, with colourless warts on the surface. The oospore usually remains attached to the oogonium in *Monoblepharis sphærica*; in *M. macrandra* they are often found separate. The germination of *M. sphærica* was not observed. In addition to *M. sphærica* Woronin found two other species, *M. polymorpha* and *M. macrandra*. Very complete descriptions of the figures drawn by Woronin were found among his papers, and are published in full, adding greatly to the value of the work. In these notes is contained a description of the zoosporangia and zoospores not included in the text.

Underground Fungi of Portugal.†—O. Mattirolo publishes a list of truffles and other subterranean fungi collected in Portugal, and adds a series of notes and observations on these plants. He finds that they correspond with the similar flora of the Mediterranean region both in Europe and in North Africa, just as the aerial vegetation of these lands is much alike. None of these southern species have the same coloration as those found in the north. They vary from white to violet or chestnut brown, while the truffles in the north are black or dark brown. The area of distribution of the different forms varies with the distribution of the plants on the roots of which they grow, and that again is determined by climate and by the character of the soil. Mattirolo records 10 species, all of them edible fungi.

Development of Ascus and Spore-formation in Ascomycetes.‡—The intention of J. Horace Faull in starting his research on Ascomycetes was to extend our knowledge of the ascus in other species, only comparatively few having been examined as yet. The most favourable

* Mém. Acad. Imp. Sci. St. Pétersbourg, ser. 8, xvi., No. 4 (1904) 24 pp., 3 pls.
† Atti Reale Accad. Lincei, cccii. (1905) pp. 384–6.
‡ Proc. Boston Soc. Nat. Hist., xxxii. (1905) pp. 77–113 (pls. 7–11).

forms he worked with were *Sordaria pinicola*, *Neotiella albocincta*, *Hydnobolites* sp., an underground fungus. Many other forms v examined, and the results are summarised. He finds that the asci out from the penultimate cells of the ascogenous hyphæ only in s forms; in others, as in *Sordaria pinicola*, they rise from the term cell; in a few species they rise apparently from any cell.

In every case that was definitely determined there was fusion of nuclei in the young ascus; the conjugating elements, though not sis might be the daughters of sister-nuclei. Bodies corresponding Guilliermond's metachromatic corpuscules were noted in the a They disappear before the spores are matured. The spindles were fc to be of intranuclear origin, the centrosomes and asters of extranu origin. The chromosomes vary in number for different species from to eight. The spores are delimited by a plasma membrane directly the last mitosis in the ascus. The nucleus, after it has acquired a wall, a pear-shaped form with a beak, the centrosome being at the beaked The formation of the spore membrane begins at the centrosome en the nucleus, and develops towards the opposite pole. An outer se membrane is also formed, and lies against the surrounding epip Retraction of the beak follows after the wall is completed, and nucleus assumes its spherical form. There was no evidence to su Harper's finding, that the astral rays fused to form the spore memb they were constantly seen within the spore and apart from the Within the spores karyokinesis may take place, with or withou formation of septa, according to the species of fungus. In *Podo* an enucleated, elongate part of each spore is cut off, the nucleus pa to the end of the spore where septation takes place.

The writer discusses at length the bearing of these facts o origin of the Ascomycetes. He concludes that the phenome spore-formation, as discovered by him, are not incompatible wit view that homologises the ascus with the oomycetous zoosporan Though there is undoubted nuclear control in the formation c spores in the ascus, even the shape of the nucleus changing i process, there is probably nuclear control also in the Zygomycete Oomycetes, where the cleavage masses are always nucleated. claims that his observations "indicate that the process of delimitat the spores is practically the same in both cases—a cleavage,—an the plasma membranes of the spores are the same." He thinks p the Ascomycetes may have arisen from some such phycomy group as the Peronosporineæ or Saprolegniineæ.

Observations on Claviceps purpurea.*—C. Engelke has making a series of culture experiments with ergot, and states tl was unable to obtain cultures from the conidia of the fungu secured spores that were ejected from the perithecia, and with th obtained a pure growth with which he was able to inoculate rye Infection only took place before pollination, and only on the s There was no infection through the stomata. Honey-dew is e

* Jahresb. Nat. Ges. Hann., 1905, pp. 70–2. See also Ann. Mycol., iii. (1 377–8.

the product of the stigma, increased somewhat by the excitation of the attack of the fungus.

R. Aderhold * has been working at the same subject, studying the conditions of the development of the fungi from the sclerotium. They grow most readily under a very slight coating of earth. Deeply buried sclerotia were never seen to germinate, but they could persist in that condition unimpaired in vitality till the following year—after that the power of growth had gone.

Conjugation of Yeast-Spores.†—A. Guilliermond again takes up the question of fusion in the spores of certain species of *Saccharomyces*. He describes the method employed in growing, fixing, and staining the yeasts, and gives an account of the results observed for each form. He devoted special study to *S. Ludwigii*. The ascus of this species contains four spores, which constantly unite in pairs in the interior of the ascus. A germinating tube is then formed, which pierces the ascus wall and cuts off a succession of cells like the budding of other species. In other cases the spores each form a germinating tube, and fusion may take place later between two tubes, or there may be no fusion at all. Guilliermond then describes the fusion of the nuclei. There is a slightly different procedure in *S. Johannisberg* ii. More than half the number of spores conjugate at the time of germination, but fusion is not so constant between spores of the same ascus. In the Schizosaccharomycetes and the Zygosaccharomycetes, fusion as a rule takes place between two cells at the formation of the ascus. In some forms there are often cases where no fusion takes place, showing a tendency to apogamy. Many deviations from the usual development are noted by the author, and comparison is drawn between these cases of fusion in yeasts and the sexual fusion noted in the Ascomycetes. He has no doubt that these fusions are veritable conjugations, though the sexuality is of a somewhat rudimentary character.

Occurrence of Saccharomyces anomalus in the Brewing of Saké.‡ K. Saito found this yeast constantly in specimens of saké from numerous localities. He grew it in various cultures, and describes at length its appearance and habits of growth. The formation of endogenous spores was easily induced; they are cap-shaped, and are 2–4 in a cell. Saito tested the effect of carbohydrates in the cultures and also the products of fermentation. In all of these, the saké yeasts resembled *Saccharomyces anomalus*. The writer is not sure of the part played by the yeast in the preparation of saké, but he thinks that the aroma is very probably due to its presence.

Conidial Form of Aspergillus niger.§—C. Engelke describes an alternative form of the fungus hitherto known as *Sceptromyces opizi*, or *Botrytis sceptrum*. The development of this second form is induced by low temperature, moisture, and lack of nitrogen in the substratum.

* Arb. Biol. Abt. Land. Forstw. k. Ges. Amt., v. (1905) p. 31. See also Ann. Mycol., iii. (1905) pp. 378-9.
† Rev. Gén. Bot., xvii. (1905) pp. 337–76 (4 pls. and 11 figs.).
‡ Zeitsch. Angew. Mikrosk. Klin. Chemie, xi. heft 5 (1905) pp. 119–29.
§ Jahresb. Nat. Ges. Hann., 1905, pp. 107–9. See also Ann. Mycol., iii. (1905) p. 373.

The form with which he experimented, *Sceptromyces*, was found growin on chestnut husks. From it he grew *Aspergillus niger*, and from culture of the latter he again produced *Sceptromyces*.

Identity of the Genera Meria and Hartigiella.* — A disease leaves of the larch was found by P. Vuillemin to be caused by a fung that developed its fruits underneath the stomata. The fertile hyph pass out through the pores and bear the spores in the open. He nam the fungus, which was new to science, *Meria Laricis*. It was at a lat date again discovered and described first as *Allescheria*, and then *Hartigiella*. Lindau, in his recent Kryptogamen-Flora, places the fung among the Botrydeæ. Vuillemin does not agree with this classificatio He considers the fungus to be the type of a new family, Hypost maceæ, characterised by the formation of a fungal layer under t stoma. He thinks that some other fungi described as Hyphomycet Melanconiaceæ, and Sphæropsideæ, ought to be placed in the new fami The fertile hyphæ are not exhausted by the formation of spores, th membranes become thickened, and they are transformed into a mass persistent cysts, something like the resting spores of the Ustilagineæ.

Origin and Spread of Plant Rusts.† — Jakob Eriksson contin the discussion on the mycoplasma theory of the origin of rusts, a criticises the opinions of those writers who have opposed this theo Eriksson does not deny that in certain cases uredo sori may pers during the winter, but he insists that it is not proved that the disease propagated by the uredospores, and questions the capacity of the to convey them. There are three distinct periods of attack: in l autumn or winter, in early spring, and towards the end of June, latter being the most widespread and harmful. All of these he sta are due to mycoplasma in the seed. He further points out that in ot parasites we have perennial mycelium, which provides for the contin growth of the fungus; in these cases spores are dispensed with, an similar life-history is to be found in rusts.

Infection of Cereals by the Smut fungus.‡—Ludwig Hecke perimented with the ears of wheat and barley, and found that the fun gained entrance by the stigma, and when the infected seeds were sown following year the smut fungus was produced. Hecke found the fun in the young embryo of the seed, in the scutellum, at the vegetat apex, and in the first formed layers of the leaves. He thinks it prob that the *Lolium* fungus is also a form of smut.

Work on Smut.§—Oscar Brefeld has issued a further portion of work on filamentous and yeast fungi. This part deals with the smu cereals. He has made a special study of the infection of the diffe plants attacked by smut. He has proved by experiments that the s spores of wheat and barley only infect the young fruit. They ali

* Ann. Mycol., iii. (1905) pp. 340–3 (8 figs.).

† Arkiv Bot. k. Svenska Vet. Akad. Stockholm, v. No. 3 (1905) pp. 1–54. also Bot. Centralbl., xcix. (1905) pp. 471–3.

‡ Ber. Deutsch. Bot. Ges., xxiii. (1905) pp. 248–50 (1 pl.).

§ Untersuch. aus dem. Ges. der Mykologie, heft xiii. Brandpilze iv. (Mun 1905) 74 pp., 2 pls.

on the stigma, the hyphæ penetrate to the developing ovule, and remain there until the following season. When the seed is sown, the fungus develops along with the host-plant, and becomes first visible as smutted heads of wheat or barley after the time of blooming. The smut spores of oats are much more resistant, and retain their vitality for some years. The method of infection is also quite different; the spores germinate on some saprophytic substance, manure of some kind, and directly infect the young plants. The spores of these plants are, like the pollen of their hosts, wind-borne. The smut spores of the maize also develop as saprophytes, and produce conidia, which are carried by the wind to the host plant; they alight on the young and tender portions of the plants and penetrate into the tissues. The disease appears on the area infected by the spores. Brefeld includes in his survey the smut of *Melandrysum*, which appears in the anthers, and the smut of water plants such as *Phragmites*. The spores of the former are carried, as the pollen is carried, by butterflies. In plants like *Phragmites* the water conveys the spores to new hosts.

The author concludes with a consideration of the part played by filamentous fungi in the assimilation of free nitrogen. He is of opinion that such assimilation is confined to the Rhizobiæ of the Leguminosæ.

Genus Phragmidium. II.*—P. Dietel has followed up a previous paper on this genus by a still more extended study of species. The material used was from herbaria in Berlin, Leipzig, and Paris. He calls attention to the uredo form and to the paraphyses which often vary a good deal and are of service in determining species otherwise very much alike. The diagnoses and descriptions of a number of new species are given. A list of the species recognised as such by the author is given with their host-plants. There are 16 on species of *Rubus*, 15 on *Rosa*, 10 on *Potentilla*, one of which grows also on *Fragaria*, the remaining 5 are parasites of *Geum*, *Ivesia*, *Poterium*, and *Sanguisorba*.

Asparagus and Asparagus Rusts in California.†—Ralph E. Smith has published an account of this Uredine, giving a history of the disease, a description of the various spore forms of the fungus, and an account of the spraying experiments. Dew is essential to the germination of the spores, and dusting with fine sulphur while dew is on the plants has been found to be effective in checking the spread of the fungus. After September the rust is kept down by the parasites *Darluca filum*, *Tubercularia persicina*, and *Cladosporium* sp. The latter is a new record.

New Genus of Uredineæ: Uromycladium.‡—The rust found hitherto on species of acacia belong to the two genera *Uromyces* and *Ravenelia*. D. McAlpine records a new genus which occurs on Australian acacias. The teleutospores of *Uromycladium* are borne at the tips of a branching sporophore, each branchlet bearing one to three spores with a colourless vesicle or cyst below the spores. With the

* Hedwigia, xliv. (1905) pp. 330–46.
† Bull. California Agric. Exper. Stat., clxv. (1905) pp. 1–100. See also Bot. Centralbl., xcix. (1905) p. 513.
‡ Ann. Mycol., iii. (1905) pp. 303–23 (4 pls. and 5 figs. in text).

exception of two species, uredospores and teleutospores have both been recorded. No æcidia have been found, but on several acacias spermogonia have been noted. The writer describes 7 species belonging to the new genus. The development of the spores is traced, and they are compared and contrasted with the spores of *Uromyces* and *Ravenelia*. The writer thinks that the function of the sterile cysts is one of adhesion. They are gelatinous, and would aid in fixing the spore on the leaf until germination took place. The uredospores are borne singly; they are larger than the teleutospores, and have several germ-pores. There are no paraphyses.

Plant Diseases.*—G. P. Clinton in his botanical report describes first of all the fungal diseases that occurred in Connecticut during the preceding year, especially on cultivated plants. He devotes a section to the discussion of *Peronoplasmopara cubensis*, the blight of musk melons and cucumbers. It attacks all species of Cucurbitaceæ, and is of wide distribution. A third section deals with *Phytophthora infestans*.

A case of conifer disease † is recorded from Yorkshire, caused by *Herpotrichia nigra*. The leaves are attacked and killed; the fruits of the fungus and small sclerotia are developed on the leaves.

A new disease of potatoes ‡ has been noted, due to *Sphærella tabifica*, already recorded as doing damage to beets and turnips. The leaves are attacked first, then the mycelium passes down the stem and enters the tubers.

Ewert § gives advice as to combating the fungus *Glæosporium Ribis*. The disease follows usually on dry hot weather, and attacks the oldest leaves. Pruning to encourage a new and vigorous growth is of advantage; the selection of immune varieties and the use of fungicides are also recommended.

In a further paper, Ewert ‖ describes an attack on roses by the rust *Phragmidium subcorticium*. A damp season was distinctly favourable to the growth of the fungus. He describes the varieties that were able to resist the parasite.

C. Brick ¶ records disease of cherry trees in the Rhine country, and gives as the cause the fungus *Cytospora rubescens* which acts on the tree in much the same way as *Nectria cinnabarina*, causing gummosis. Removal and burning of diseased branches, protection of wounds by tar and supply of water to the trees in dry seasons, are recommended. Fungicides are of no avail.

F. W. Neger** has made a series of notes on timber-infesting fungi. At Mariental, near Eisenach, he found many hornbeams of which the

* Rep. Conn. Agric. Exper. Stat., 1904 (May 1905) pp. 311–84 (pls. 18–37). See also Ann. Mycol., iii. (1905) pp. 372–3.

† Journ. Board of Agric., xii. (1905) pp. 177–8.

‡ Tom. cit., pp. 37–8.

§ Naturw. Zeitschr. Land. Forstw., iii. (1905) p. 200. See also Bot. Centralbl. xcix. (1905) p. 405.

‖ Tom. cit., pp. 249–52. See also Bot. Centralbl., xcix. (1905) p. 405.

¶ Verh. Naturw. Ver. Hamburg, 1904 (1905) pp. 66–7. See also Ann. Mycol. iii. (1905) p. 381.

** Festschr. zur Feier 75 Jährig. Besteh. Forstlehr. Eisenach, 1905, pp. 86–9. See also Ann. Mycol., iii. (1905) pp. 381–2.

branches were killed by *Irpex obliquus*. He describes the fungus and its effect on the woody tissues.

Another fungus, *Lasiobotrys Loniceræ*, he found was subcuticular in growth; the fungus could hardly therefore belong to the Perisporiaceæ, which are all superficial forms.

R. Aderhold * contributes a paper on the question of the utility of burying harmful fungi. It might be beneficial if care were taken not to turn over the ground again in spring. This remedy is still more doubtful in the case of sclerotia, that retain their vitality for several years.

In discussing the spread of rust on maize and cereals, J. C. Arthur † points out the prevalence of *Puccinia Sorghi* in the uredospore stage, while the æcidium, recently discovered on *Oxalis*, is very rare. He thinks that the uredospores must cause most of the spread of the disease.

G. Delacroix ‡ recounts the work done at the station for vegetable pathology in France. In the first part he describes the parasitic fungi that have recently been recorded as attacking cultivated plants, such as melons, almonds, etc., and in the second part some new species that have been found on the cultivated plants of warm climates. Most of the species described are new to science.

W. H. Lawrence § describes blackspot canker and blackspot apple rot, a disease that grows in the bark and sapwood of the tree, where it forms a stroma and pustules of *Macrophoma curvisporum*. When the fruit is attacked spots are formed on which the pustules of the fungus make their appearance.

Fr. Kruger ‖ finds that "ring-scab" of sugar beet is due to an *Oospora* which enters by wounds caused by an insect. In slight attacks the superficial tissues alone are affected, but in more serious cases the deeper tissues are reached and the vessels are laid bare. Unfavourable conditions of the soil are the chief causes of the disease.

Plant Diseases in Britain.¶—A case of potato leaf-curl has recently occurred at Kew. It is due to a black mould, *Macrosporium Solani*, which forms velvety black patches on the leaves and haulms. In some instances the mycelium passes down the haulm into the tuber, which may again reproduce the disease. Young sprouts are readily infected by the fungus.

Attention is also called ** to the white rust of cabbages. The fungus *Cystopus candidus* attacks many species of Cruciferæ, both cultivated and wild. Shepherd's purse is the commonest host, and should be eradicated.

Advice is given †† as to the best treatment of vines afflicted with

* Arb. Biol. Abt. Land. Forstw. k. Ges. Amt., v. (1906) p. 35. See also Ann. Mycol., iii. (1905) p. 382.

† Proc. Soc. Prom. Agric. Sci., xxvi. (1905) pp. 94–8. See also Bot. Centralbl., xcix. (1905) p. 486.

‡ Bull. Soc. Mycol. France, xxi. (1905) pp. 168–204 (with figures).

§ Journ. Mycol., xi. (1905) pp. 164–5.

‖ Arb. Biol. Abt. Land. Forstw. k. Ges., iv. part. 3 (1904) 1 pl., 9 figs. See also Bot. Centralbl., xcix. (1905) p. 506.

¶ Journ. Board of Agric., xii. (1905) pp. 476–8 (1 fig.).

** Tom. cit., pp. 480–1 (2 figs.)

†† Tom. cit. pp. 494–6 (2 figs.).

"white rot." This is caused by the fungus *Coniothyrium diplodiella*, which most frequently attacks the fruit and destroys every grape on the bunch. Occasionally it spreads to the branches, causing pale-coloured patches. The best remedy is to burn all diseased parts of the plant, and to spray at intervals with permanganate of potash.

Endophytes of Orchideæ.*—B. Noel has isolated the fungus from the roots of several orchids, the presence or absence of which determine the ripening of the seeds. The writer was able to distinguish the different fungi from each other. The one on *Phalænopsis* for instance was able to form sclerotia, and is compared with *Rhizoctonia Solani*.

Case of Symbiosis.†—Franz Zach found a fungus growing symbiotically with an *Erineum* on lime leaves, due to a gall mite. The gametes, copulation, and swarm-spores of the fungus were observed, bu the systematic position is still uncertain. Presumably the mite, b irritation of the host plant, induces a suitable substratum for the fungus and the fungus pierces an opening through the cell wall by which th mite is enabled to pass through and reach further food supplies.

Mycological Notes.‡—Fr. Cavara takes exception to A. P. Morgan' criticism of his genus *Gibellula*, even while adding a new species to i He thinks Morgan has misunderstood his diagnosis, and that the specie *Gibellula capellaris* Morgan cannot be considered as belonging to th genus. Cavara also draws attention to Claussen's work on *Boudier* He lays great stress on the cytological value of the paper, but sugges that Claussen has made a mistake in the determination of the fungus o which his observations were made. Cavara considers it to be a speci already described by Van Tieghem as *Ascodesmis nigricans*. The writ gives full reasons to justify his criticisms.

Guide to Fungology.—Edm. Michael § has just issued the thi volume of a work dealing with the principal larger fungi, edible ar poisonous. He describes the common forms of fields and woods, ar also describes a few rare plants, such as *Clathrus cancellatus*. The chi characteristics of the fungi are pointed out, and the 131 drawings a arranged on 10 plates for use in schools.

B. Studer-Steinhaüslin ‖ has drawn and described the most importa edible fungi of Switzerland. Attention is also directed to poisono forms that might be mistaken for the others.

American Mycology.—A. P. Morgan ¶ publishes a new species *Kalmusia* and a note on *Peziza pubida*, the synonymy of which is doul ful as the various spore measurements of species show great divergenc

J. J. Davis ** has found a new species of *Synchytrium* on the lea of *Scirpus*. It produces little distortion of the host.

* Comptes Rendus, cxl. (1905) p. 1272. See also Ann. Mycol., iii. (1905) p. 3

† Jahresb. k. k. Franz.-Josefs-Staatsgymn. Saaz (1905) p. 1–5 (2 pls.). also Bot. Centralbl. xcix. (1905) pp. 407–8.

‡ Ann. Mycol. iii. (1905) pp. 362–5.

§ Zwickau, Sax. (Förster and Borries) 1905.

‖ Die Wicht. Speisepilze der Schweiz. 3 Aufl. (Berne, 1905) 24 pp. (12 col. pl

¶ Journ. Mycol., xi. (1905) pp. 153–4. ** Tom. cit., pp. 154–6 (2 figs.).

E. W. D. Holway* redescribes the rust hitherto recorded on plants of *Salvia* in North America. He adds diagnoses of several new species that he himself has discovered.

Joseph F. Clevenger † publishes preliminary notes on the genus *Phyllachora*; 44 species occur in North America and of those he has examined 22. The notes deal largely with the differences between the size of the spores in the specimens examined and of evidently similar species recorded by authors. The writer supplies fuller diagnoses in several instances.

D. D. Sumstine ‡ considers that *Gomphidius rhodoxanthus* ought to be placed in the genus *Boletinus*. He gives his reasons for the suggested change and the various synonyms of the fungus.

Contributions to Mycology.§—Franz v. Höhnel describes a new species of *Exidiopsis*. He hazards the opinion that *Stypella* may be identical with *Exidiopsis*. He records and describes several new species, and gives notes on some species of *Corticium* and also on *Actinonema Rubi*, which has been recorded under various names. The new genera he has discovered are: *Acanthostigmella* (Pyrenomycete), *Didymascina* (Hysteriineæ), and *Thyrsidina* (Melanconieæ). Höhnel finds that the spot disease of *Robinia* chronicled by many observers is due to a *Phleospora*. The fungus has been placed in five other genera by various authors. *Exosporium Ononidis* Auersew, which has been imperfectly described, is a *Cercospora* with elongate brownish septate spores.

Plant Pathology.‖—M. Hollrung's account of the diseases of plants recorded in 1904 has just been issued. The volume includes an account of the ravages caused by animals as well as by fungi or other plants. The first division is devoted to the general consideration of phytopathology. Then follow special pathology and the diseases that attack the various plants. These are discussed, the views and discoveries of the various workers are stated, and the methods of cure considered by them to be most effective. Plant hygiene occupies a more important place in the volume than heretofore, owing to the attention that is being directed to the producing of immune varieties, and to studying the soil and other conditions that help to keep the plants healthy and resistant. Under plant therapeutics are discussed the various means that have been tried to stamp out disease during the year: certain fungi are found useful in exterminating animals, and some insects and ants are encouraged that prey on other insects or on plants considered undesirable. Fungicides and insecticides are also passed under review. A full index completes the volume.

Handbook of Technical Mycology.¶—F. Lafar has issued the seventh part of this work, beginning the fourth volume. A. Kloecker writes the chapters on Saccharomycetes and Schizosaccharomycetes, giving an account of their development and life-history. F. Lafar and P. Lindner

* Journ. Mycol., xi. (1905) pp. 156–8. † Tom. cit., pp. 159–64 (1 pl.).
‡ Tom. cit., pp. 165–6. § Ann. Mycol., iii. (1905) pp. 323–39.
‖ Jahresb. Pflanzenkr., vii. (1904). Berlin: Paul Parey, 1905, viii. and 374 pp.
¶ Handbuch der technischen Mykologie, lief 7, Jena, 1905. See also Bot. Centralbl., xcix. (1905) p. 424.

take up other points in the science of yeasts: their culture, physiolog spore-formation, etc. H. Will, of Munich, treats of the chemistry (the cells and their contents: cell-wall, nucleus, vacuoles, granules, etc.

BAINIER, G.—**Sur deux Penicillium.** (On two species of *Penicillium*.)
Bull. Soc. Mycol. France, xxi. (1905) pp. 126–30 (1 pl

BERGAMASCO, G.—**Basidiomiceti ed Ascomiceti.** (A list of 51 fungi collected l the author in the spring of 1905 in the wood of the Camaldoli.)
Nuov. Giorn. Bot. Ital., xii. (1905) pp. 652-

BLYTT, AXEL.—**Norges Hymenomycetes.** (Norwegian Hymenomycetes examin and finished after the death of the author, by E. Rostrup.)
[The number of species is 1197. There are several new to science.]
Vidensk. Selbsk. Skr. I. Math. Naturw. Cl., No. 6, 19
(Christiana, 1905) pp. 1–164. See also *Bot. Central*
xcix. (1905) p. 5

BRUMPT, E.—**Sur le Mycétome à grains noirs, maladie produite par une Mucedin du genre Madurella n.g.** (On the mycetomy of black grains, a disease produc by a mould of a new genus, *Madurella*.)
C.R. Soc. Biol., 1905, pp. 997–8. See a
Bot. Centralbl., xcix. (1905) p. 4

BUBAK, FR., & J. E. KABAT—**Mykologische Beiträge III.** (Mycological c tributions.)
[Diagnoses of 19 new species of mic fungi from Bohemia.]
Hedwigia, xliv. (1905) pp. 350

" " " " **Viertes Beitrag zur Pilzflora von Tirol.** (Fou contribution to the fungus flora of the Tyr
[Diagnoses of new species are given, critical notes on many of the fo recorded.]
Oester. Bot. Zeitschr., lv. (1905) pp. 7
181–6, 239–45 (1]

CHELCHOWSKI, S.—**Rosa macazna agrestu.** (Gooseberry mildew.) (Polish.)
[An account of the further spread of this fung *Sphærotheca mors-uvæ*.]
Wszechświat (Weltall). Warschaw, 19
No. 29, pp. 452–5. See also
Centralbl., xcix. (1905) p.

" " **Trufle Warszawskie.** (The truffles of Warsaw.)
[The author found the so-called truffles were *Rh pogon* and *Scleroderma*.]
Tom. cit., No. 33, pp. 525–6. See
Bot. Centralbl., xcix., pp. 48

CLINTON, G. P.—**The Ustilagineæ or Smuts of Connecticut.**
[A discussion of the life-history of smuts, and descriptions of species occur in the region. With a list of hosts and 7 pages of figures.]
Conn. State Geol. Nat. Hist. Survey, Bull. v. (1905) pp. 1
See also *Bot. Centralbl.*, xcix. (1905) p.

COPELAND, E. B.—**New Species of Edible Philippine Fungi.**
[Diagnoses in English of the various species of *Coprinus*, *Psalliota*, *Lepiota*.] Depart. of the Interior, Bureau of Gov. I
Manila, 1905, pp. 141–6 (3]

COSTANTIN & LUCET—**Recherches sur quelques Aspergillus pathogènes.** searches on some pathogenic species of *Aspergillus*.)
Ann. Sci. Nat., ser. 9, ii. (1905) pp. 119–71 (1

CROSSLAND, C.—**Fungus Foray at Maltby.**
[An account of the annual meeting of the mycological section of the Yorkshire Naturalists' Society.]
Naturalist, 1905, pp. 337-9.

" " **Yorkshire Naturalists at Pocklington.**
[Includes a report of the fungi for the district.]
Tom. cit., pp. 267-9.

" " **Yorkshire Naturalists at Barnsley.**
[Includes a report of the fungi for the district.]
Tom. cit., pp. 295-6.

" " **New Yorkshire Mould: Myxotrichum deflexum.**
Tom. cit., p. 254.

" " **Fungi.**
[Notes on various new records of Yorkshire fungi.]
Tom. cit., pp. 189-90.

DOP, PAUL—**Sur un nouveau Champignon, parasite des Coccides du genre Aspidiotus.** (A new fungus parasite on the Coccideæ of the genus *Aspidiotus*.)
[The fungus is a Hyphomycete, *Hyalopus Yvonis*.]
Bull. Sci. France & Belgium, xxxix. (1905) pp. 135-40 figs. 1-3).
See also *Bot. Centralbl.*, xcix. (1905) p. 505.

DUSS, LE R. P.—**Flore Cryptogamique des Antilles Françaises.** (Cryptogamic Flora of the French West Indies.)
[List of fungi includes a number of new species, determined by Patouillard.]
Lons-le-Saunier, 1904, pp. 211-304.

ERIKSSON, JAKOB—**Den Amerikanska Krusbärsmjöldaggen på Svensk mark.** (The American gooseberry mildew in Sweden.)
[The disease was introduced from Denmark with young gooseberry plants.]
Medd. k. Landtbr. Akad. Exper. k. Landtbr. Akad. Handl. Tidsskr. Stockholm, No. 87 (1905) pp. 1-16 (1 pl.).
See also *Bot. Centralbl.*, xcix. (1905) p. 505.

FARLOW, W. G.—**Bibliographical Index of North American Fungi—Abrothallus to Badhamia.**
[Contains a list of fungi and references, with occasional notes by the author.] *Carnegie Institution of Washington*, i., pt. 1 (1905) 312 pp.

FRIEDEL, JEAN—**Quelques remarques sur l'influence de l'acidité et de l'alcalinité sur deux Aspergillées.** (Some remarks on the influence of acidity and alkalinity on two species of *Aspergillus*.)
Bull. Soc. Mycol. France, lii. (1905) pp. 182-3.

GATES, R. R.—**Middleton Fungi.**
[A general account of fungi; the species occurring at Middleton are included in Mackay's Fungi of Nova Scotia.]
Proc. and Trans. Nova Scotian Inst. Sci., xi. (1905) pp. 115-21.

GIBB, THOS.—**New Yorkshire Fungi.**
[A note on two Pyrenomycetes, one of them, *Sordaria* (*Philocopra*) *pusilla* Mout. & S., new to Britain.] *Naturalist*, May 1905, p. 139.

HEIMERL, ANTON—**Beitrag zur Flora des Eisacktales.** (Contribution to the Flora of the Eisach Valley.)
[A long list of fungi is included in the flora.]
Verh. Zool. Bot. Ges. Wien, lv. (1905) pp. 444-74.

LAFAR, F.—**Handbuch der technischen Mykologie.** (Handbook of technical mycology.)
[Omelianski and J. Behrens write further chapters on Bacteriology and Physiology; F. v. Tubeuf takes up the fungi that destroy wood.]
Jena, 1905, lief vi.

LAUBERT, R.—**Die Schwarzfleckenkrankheit (Rhytisma acerinum) der Ahornblätter.** (The black spot disease of maple leaves.)
[The dead leaves on which the fungus matures should be gathered and destroyed.] *Biol. Abt. Land. Forstw. k. Ges.*, No. 29 (1904) 4 pp. (2 figs.). See also *Bot. Centralbl.*, xcix. (1905) pp. 506-7.

LUTZ, L.—**Sur une déformation de l'appareil sporifère du Sterigmatocystis ni dans certains milieux artificiels.** (On the deformation of the sporophore *Sterigmatocystis nigra* in certain artificial media.)
Bull. Soc. Mycol. France, xxi. (1905) pp. 131–6 (1 fi

MACKAY, A. H.—**Fungi of Nova Scotia. A Provisional List.**
[The habitat of the species is indicated, with the locality. A few n species are described.]
Proc. and Trans. Nova Scotian Inst. Sci., xi. (1905) pp. 122–

MAGNUS, P.—**Die Pilze (Fungi) von Tirol, Vorarlberg, und Liechtenstein.** (Fu of Tyrol, Vorarlberg, and Liechtenstein.)
[Magnus writes of the Fungi, Schizomycetes, and Myxor cetes. The other authors are v. Dalla-Torre and Lud Grafen von Sarnthein.]
Innsbruck : Wagnersche Universitäts-Buchhandlu 1905, liv. and 716 pp. See also *Hedwigia*, (1905) Beibl. p

„ „ **Zwei parasitische Harpographium-Arten und der Zusammenh einiger Stilbeen mit Ovularia oder Ramularia.** (Two paras species of *Harpographium* and the connection between s Stilbeæ and *Ovularia*, or *Ramularia*.)
Hedwigia, xliv. (1905) pp. 371–5 (5 fi

„ „ **Über die Gattung, zu der Rhizophydium Dicksonii Wright geh** (Concerning the genus to which *Rhizophydium Dicks* Wright belongs.)
[The fungus grows on *Ectocarpus*; Magnus establi for it a new genus, *Eurychasma*.]
Tom. cit., pp. 347–9 (3 fi

MAIRE, RENÉ—**Notes sur quelques Champignons nouveaux ou peu connus.** (N on some new or rare fungi.)
[New records are given, new hosts for parasites, changes of name ar dicated, and new species are described.]
Bull. Soc. Mycol. France, xxi. (1905) pp. 137–67 (5 fi

MURRILL, W. A.—**A Key to the Brown Sessile Polyporeæ of Temperate N America.**
[The author makes three groups of Polyporaceæ : the Polyporeæ, Fomi and Agaricaceæ. The key deals with the first group.]
Torreya, v. (1905) pp. 1

NOELLI, ALBERTO—**Contribuzione allo studio dei micromiceti del Piem** (Contribution to the study of the micromycetes of Piedmont.)
[The author records 199 species. One, *Amphisphæria Heraclei*, is ne science.] *Malpighia*, xix. (1905) pp. 32

NOMURA, H.—**Intorno alla ruggine del Rengesò (Astragalus sinicus) et a due micromiceti patogeni del gelso.** (Concerning the disease of the "Reng (*Astragalus sinicus*) and two new pathogenic micromycetes of the mulber
Atti Istit. Bot. d. Pavia, ix. (Genn 1904) pp. 1
See also *Bot. Centralbl.*, xcix. (1905) pp. 5

PAMMEL, L. H.—**Some Fungus Diseases common in Iowa during the Sea 1904.** *Proc. Soc. Prom. Agric.* xxvi. (1905) pp. 6

„ „ **The Cedar Apple Fungi and Apple Rust in Iowa.**
[An account of the fungus *Gymnosporangium* pa on apples.
Bull. Iowa Agric. Exper. Stat., lxxxiv. pp. 1–36. See also *Bot. Centralbl.*, (1905) pp. 5

PATOUILLARD, N.—**Champignons algéro-tunisiens nouveaux ou peu** (Algero-Tunisian fungi new or little known.)
Bull. Soc. Mycol. France, xxi. (1905) pp. 1

PECK, C. H.—**Report of the New York State Botanist.**
[New records are published for a large number of fungi, and many of the names have been changed.]
Bull. N.Y. State Museum, xciv. (1905) pp. 1–58 (10 col. pls.) See also *Bot. Centralbl.*, xcix. (1905) p. 489.

REHM, H.—**Contributiones mycologicæ ad floram Hungariæ.**
[The contributions include the descriptions of many new species and varieties. There is one new genus of Pyrenomycetes, *Lojkania*, closely allied to *Neopeckia*.] *Növénytani Koslemènyak*, iv. (1905) pp. 1–6. See also *Ann. Mycol.*, iii. (1905) p. 376.

RICK, J.—**Fungos dos arredores de Torres Vedras.** (A list of fungi for Torres Vedras.) *Brot. Rev. Sci. Nat. Collegio de S. Fiel (Portugal)* iv. fasc. 3 (1905) pp. 159–63. See also *Bot. Centralbl.*, xcix. (1905) p. 512.

ROLLAND, L.—**Adherence de l'anneau et de la volve dans les Psalliotes, Psalliota arvensis et Psalliota Bernardi.** (Adherence of ring and volva in *Psalliota arvensis* and *Ps. Bernardi*.)
Bull. Soc. Mycol. France, xxi. (1905) pp. 123–5.

SAITO, K.—**Tieghemella japonica sp. n.**
[This new species arose from spores collected in the saké-brewing chamber. Description and diagnosis are given.]
Zeitschr. Angew. Mikrosk. Klin. Chemie, xi. heft 6 (1905) pp. 143–9.

SHERMAN, HELEN—**The Host Plants of Panæolus Epimyces Peck.**
[This fungus is parasitic on species of *Coprinus*.]
Journ. Mycol., xi. (1905) pp. 167–9 (1 pl.).

STEIDLER, EMMERICH—**Hymenomycetes moravici.** (Moravian Hymenomycetes).
[A number of new species are described.]
Zeitschr. Mähr. Landesmus. V. Brünn, heft 2 (1905) 15 pp. See also Bot. *Centralbl.*, xcix. (1905) p. 384.

STRACHEN, JAS.—**Occurrence of Peziza Adae in Ireland, with a Note on the Conditions attending its Growth.**
Irish Naturalist, xiv. (1905) pp. 185–7 (1 pl.).

ZELLNER, JULIUS—**Zur Chemie des Fliegenpilzes (Amanita Muscaria).** (On the chemistry of the Fly Agaric, *Amanita muscaria*.)
SB. k. Akad. Wiss. Wien, Math. Naturw. Cl., cxiv. abt. 116 (1905) pp. 253–73. See also *Bot. Centralbl.*, xcix. (1905) p. 474.

Lichens.

(By A. LORRAIN SMITH.)

Bavarian Lichens.*—H. Rehm has studied the lichen flora of the Keuper formation in Middle Franconia. He gives a map and description of the district. The crustaceous rock forms are largely those that grow on sandstone. The lichens were found on very old oaks and pear trees, while Cladonias grew in wide stretches on sandy soil. He found 380 species in the neighbourhood.

French Lichens.†—J. Harmand has issued the first part of a systematic and descriptive catalogue of lichens for the whole of France. He gives in the introduction an account of their nature and habitat and of

* S.A. Denkschr. k. Bot. Ges. Regensburg, ix., n.s., iii. (1905) 59 pp. See also Bot. Centralbl., xcix. (1905) pp. 515–16.
† Lichens de France. Paris: Paul Klincksieck, 1905, xxiv. and 156 pp. (7 pls.).

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the vegetative and reproductive organs. He discusses also the questi of classification, and selects, as the most comprehensive, the one follow by Nylander and Hue. This first part includes the lichens with bl green algæ down to the end of the Collemaceæ. An index is provid of the groups dealt with.

Some French Lichens.—G. Pagny* writes a note on the occurre of *Usnea longissima* in a fertile condition in the Vosges, the fi collection of the fruiting form in France. One of the specim measures 4½ metres, another 2½ metres.

F. G. Parrique† writes on the Cladonias of the French flora. informs his readers first of all as to his interpretation of the te species, variety, and form. He then divides his plants into 43 spec grouped into 16 sections. He describes some 66 plants.

ALMQUIST, N.—**Bidrag til Kännedomen om Skånes Lafflora.** (Contribution to knowledge of the Lichen-Flora of Schonen.)
[186 species are recorded.]
Arkiv Bot., ii. No. 6 (1904) pp. 1–30. See *Bot. Centralbl.* xcix. (1905) p.

BRITZELMAYR, MAX.—**Ueber Cladonia degenerans Fl. und digitata Schaer.** *Cladonia degenerans* and *Cl. digitata*.)
[The author describes the different recognised forms, and adds critical descriptive notes.] *Hedwigia*, xlv. (1905) pp. 4

DUSS, L. R.-P.—**Flore Cryptogamique des Antilles Françaises.** (Cryptog Flora of the French West Indies.)
[The Lichens have been determined by Ed. Wainio; there are a few species.] Lons-Le-Saunier, 1904, pp. 30

FERNANDEZ, D. MANUEL LLENAS Y.—**Enumeración y distribución geogr de los Peltigeráceos en Cataluña.** (Enumeration and geographical distrib of Peltigeraceæ in Catalania.)
Bol. Real. Soc. Esp. Hist. Nat., v. (1905) pp. 16

NAVÁS, R. P.—**Notas lichenologicas IV. Los Cladoniáceos de España.** (Lic logical notes IV. The Cladonieæ of Spain.)
Op. cit., iv. (1904) pp. 226–36. Se *Ann. Mycol.*, iii. (1905) p

Schizophyta.

Schizomycetes.

Bacillus Indurans. —R. Greig Smith gives the following descri of *B. indurans* sp. n., a bacterium which has the novel proper hardening gelatin. Rods with rounded ends, varying in size from 2·2 μ. They are actively motile and the flagella are numerou peritrichous. They are negative to Gram, and do not form spores. colonies are mostly white, flat, and round, while the medium gra assumes a reddish mahogany hue and also is rendered inso On potato the growth is scanty and yellowish, the medium bec

* Bull. Soc. Sci. Nancy, 3rd ser., vi. (1905) 6 pp. See also Bot. Centralbl (1905) p. 429.

† Actes Soc. Linn. Bordeaux, lix. (1905) 76 pp. See also Bot. Centralbl (1905) p. 429.

‡ Proc. Linn. Soc. N.S.W., xxx. (1905) pp. 339–43.

purplish and later brownish. Bouillon is rendered turbid with the formation of a surface ring and a coherent sediment. Indol is formed, and nitrates reduced to nitrites. Milk remains unaltered.

Defatted Tubercle Bacilli.*—J. Cantacuzene finds that dead and defatted tubercle bacilli are toxic. Injection of a big dose rapidly causes death with hypothermia, necrosis of the immigrant leucocytes, degeneration of the renal epithelium, of the heart and muscle, and a marked eosinophilia. In smaller doses, the effects produced are eosinophilia, hypothermia, emaciation, formation of abscesses, and enormous enlargement of the spleen. The tuberculous new formations caseate and are finally completely absorbed by the agency of giant-cells. The inoculated animals react to tuberculin for several weeks. The defatted bacteria when treated with Gram's iodine solution lose their toxicity, and injection of such an emulsion imparts a considerable tolerance. The absorption of the defatted bacteria and of the tuberculous deposit is hastened by daily injections of potassium iodide, which stimulates the phagocytic power of the mononuclear leucocytes.

Bacteria and the Emission of Light.†—In a small brochure, H. Molisch deals with the subject of emission of light by plants. The production of light is confined to fungi, bacteria and Peridinæ in the plant world. The author determined that the luminosity of meat is caused by a bacterium, and showed that the bacterium can generally be produced in a few days by partially immersing a piece of meat in brine. The emission of light from wood has been traced to the same source, and similarly decaying leaves of oak and beech may become luminous. The connection between nutrition, growth, and luminosity has been studied by Beijerinck. As to the teleological factor in the production of light, little is known except that it is an oxidation process. The author postulates a substance, photogen, that produces light waves in the presence of oxygen.

Bacillus Enteritidis, Gaertner, and Bacillus pseudo-Tuberculosis, Pfeiffer.‡—The chief differential characters, says E. Klein, between the bacilli of the Gaertner group and the *Bacillus pseudo-tuberculosis* are the following: The former are motile and multiflagellate; *B. pseudo-tuberculosis* is non-motile. The former produce gas in gelatin shake cultures; the latter do not. The former produce a uniform turbidity in broth and in phenol broth; the latter form granules and flocculi, the broth remaining clear. In MacConkey's fluid the former produce acid and gas; the latter do not. Subcutaneous injections of *B. pseudo-tuberculosis* give rise to chronic granulomatous inflammation; while injections of *B. enteritidis* cause acute septicæmic infection.

Differential Criterion between Cholera Vibrio and certain other Vibrios: the action of Formalin on their Gelatin Cultures.§—Mavrojannis shows that formalin in gelatin cultures fixes the gelatoses

* Ann. Inst. Pasteur, xix. (1905) pp. 699–714.
† Die Lichtenwickelung in den Pflanzen. See Nature, Nov. 23, 1905, p. 85.
‡ Trans. Patholog. Soc., lvi. (1905) pp. 132–5.
§ Journ. de Phys. et de Path. gén., vi. (1904) pp. 273–7. See also Centralbl. Bakt., 1te Abt., xxxvii. (1905) p. 270.

(representing the first stage of pepton formation) but not the peptone Cholera bacillus liquefies gelatin but with formalin gives fixed gelatoses the vibrios of Finckler, Prior, Deneke, and Metchinkoff, on the othe hand, liquefy gelatin which does not solidify with formalin, consequentl here exists an important aid in distinguishing closely allied vibrio Epidemiologically, however, this unfortunately is of little value, sinc 10–12 day old cultures are necessary, and the formalin must act for a least as long a time.

Revision of Coccaceæ.*—C. E. A. Winslow and Anne F. Roge suggest the following classification :—

Family—Coccaceæ
- Sub-Family—Paracoccaceæ (new sub-family)
  - Genus 1—Diplococcus
  - „ 2—Streptococcus
- Sub-Family—Metacoccaceæ (new sub-family)
  - Genus 3—Micrococcus
  - „ 4—Sarcina
  - „ 5—Ascococcus

Classification of Dysentery Bacilli.†—H. Hiss divides the dysente bacilli into four groups, according to their fermenting actions: (Bacillus of Shiga and Kruse ferments monosaccharides quickly and oc sionally maltose; (2) bacillus *y* ferments monosaccharides and mann in 24 hours, and sometimes maltose; (3) Strong's Philippine cult easily ferments monosaccharides and mannite, comparatively quicl saccharose, and gradually maltose; (4) Flexner's Manila culture a Duval's Baltimore culture, readily ferment all the above and dextr Typhoid bacilli do not ferment saccharose, and further are motile and can be distinguished from (4). Classification is supported by agglutination reaction. The Shiga-Kruse bacillus possesses several w known and easily distinguished varieties, if not different species.

Diagnostic and Prognostic Significance of Lochial Bacteria.‡ Leo Arnold's examination of lochia in 36 normal and 26 febrile pu peral women resulted in the following conclusions:

1. Absence of streptococci excludes the most severe puerp affections, the fever arising from extragenital causes, e.g. retai secretion, sapraemia, gonococcal infection, or more rarely coli, diphthe or tetanus.

2. Presence of streptococci, numerous and in long chains, more s the uterus than vagina, denote frequently severe infection: (*a*) chain four frequently occur in normal puerperal women; (*b*) chains of n than four cocci in vaginal lochia suggest infection and cause febril subnormal temperature; (*c*) chains of more than four cocci in ute lochia occur only in fever, though it is impossible to diagnose seve from length of chains.

3. The prognosis varies directly with the number of phagocytes.

* Technology Quarterly, xviii. (1905) pp. 240–6.

† Journ. of Med. Research, xiii. (Dec. 1904). See also Centralbl. Bakt., 1te xxxvii. (1905) p. 273.

‡ Münch. Mediz. Wochenschr., 1904, No. 48. See also Centralbl. Bakt., 1te Ref., xxxvii. (1905) pp. 274–5.

Diagnosis of Bacteria by their Biochemical Functions.*—L. Grimbert says that the fermentative activity of a micro-organism is its most constant property, and a knowledge of biochemical function is extremely important for determining species. The practical rule is that each form which assumes another constant function deserves a new name; cultural characters are only of secondary importance.

The choice of media is important; owing to complicated composition (defying chemical analysis) uniformity is impossible. Glucose in bouillon is the chief cause of alkali or acid production. Pepton after 48 hours inoculation with *B. coli* should give the indol reaction, and it ought not to be mixed with nitrogenous substances (hence peptonised bouillon is excluded) or carbohydrates or nitrates. The choice of fermentable media is to be restricted to the simplest and most characteristic substances, e.g., coagulated albumen for trypsin production, milk as a coagulation index, pepton for indol reaction, urine for production of ammonium carbonate by urobacteria of Miguel, nitrates to distinguish true denitrification ferments (*Bacillus pyocyaneus* liberates nitrogen from pepton solution) from indirect denitrificators, which only work in amido-containing media, e.g. bouillon. The best medium for this is pure potassium nitrate 1 part, pepton 1 part, distilled water 100 parts. Carbohydrates are valuable if chemically pure, and should be mixed with pepton. Solid media, the reaction of which is never constant, are not to be used. Fluid media are to be neutralised with calcium carbonate.

The plan of research includes general biology and morphology, cultural characteristics in various media, biochemical characters, agglutination phenomena, and animal inoculation.

From personal biochemical research he discusses finally:—

1. *Bacillus orthobutylicus* and its differentiation from other anaerobic butyric acid ferments.

2. Friedländer's pneumobacillus which acts energetically on glycerin and dulcitol, producing in certain cases lævo-lactic acid. Two groups of this bacillus are distinguished, viz.: Frankland's bacillus, with no action on glycerin and dulcitol, and Grimbert's bacillus, one variety of which attacks glycerin and dulcitol, the other glycerin alone; both groups with mannite give lævo-lactic acid.

3. Identity of Friedländer's bacillus with *B. lactis aerogenes*. Characters common to both are—immobility, presence of capsules, non-liquefaction of gelatin, no indol formation, and energetic action on carbohydrates.

4. *B. tartaricus* (Grimbert 1897) and its energetic action on tartrates and carbohydrates (producing acetyl-methyl-carbinol).

5. The action of *B. coli* and *typhosus* on nitrates, which are only indirect denitrificators, working only in the presence of amido compounds.

Differentiation and Identification of Streptococci and Staphylococci.†—M. H. Gordon reports the results of his observations on a large number of streptococci obtained from various sources, particularly as

* Archiv de Parasitol., vii. pp. 237–305. See also Centralbl. Bakt., 1te Abt. Ref., xxxvii. (1905) pp. 263–5.

† Local Gov. Board Supp. Medical Officer's Rep., 1903–4, p. 388.

regards their biochemical actions on certain organic compounds, whic serve to differentiate and identify the varieties of these organisms. H has selected nine tests for this purpose, viz. litmus milk, neutral re broth, and broths containing respectively saccharose, lactose, raffinos inulin, salicin, coniferin, and mannite, and as additional tests in speci cases he uses broths containing rhamnose, glycerin, and sorbite; th reactions of the various streptococci to these tests are given in tabula form. The author has applied similar methods of observation t staphylococci obtained from different sources. Although this group o cocci admits of subdivision into three main types according as the colou of the colonies is white or grey, yellow, and orange or golden, the autho finds that the varieties found in these types may be differentiated an identified by their biochemical reactions, and he has established nin tests for this purpose, viz. liquefaction of gelatin, clotting of mill peptonising of milk, reduction of nitrates to nitrites, changing of colou of neutral red broth, production of acid in litmus broths containin respectively lactose, maltose, glycerin, and mannite.

Bacillus of the Olive Tubercle.*—E. F. Smith, referring to a pap by Schiff, in which it is stated that the bacillus of the Olive Tuberc coagulates milk and readily forms spores which are very resistan surviving 15 minutes exposure to 120° C., finds, after long continuou observation of three different strains of this organism, that it does n produce spores in broth, none being visible under the Microscope, ar cultures are sterilised by exposure for 10 minutes at 50° C.; he fin also that milk is neither coagulated nor rendered acid, but gradual becomes alkaline. By inoculating healthy plants with cultures of th organism tumours resulted, control inoculations failing. He thin that no olive tubercles can be produced with pure cultures of the spo bearing organism of Schiff; this bacillus has peritrichous flagella, or non-motile, whereas the true olive knot organism is motile and h several polar flagella.

Microbes in Cheese-Making.†—P. Mazé finds, from the results his researches, that cheese-making depends entirely on lactic fermen tion and the phenomena that accompany it. Lactic acid fermentatio eliminate or hinder all the other fermentations liable to be present the milk; they facilitate the drying of the cheese, and communicate the casein the aroma of butter and cheese. When the refining of cheese commences, the lactic acid ferment dissolves a part of the case but the other ferments also act in the process, as shown by the case they produce, and by the ammonia they set free. The best cheeses c tain neither lactic acid nor ammonia, since these favour a too comp solution of the casein and the formation of nitrogenous matters a toxic products dangerous to the consumers. He advocates the empl ment, in cheese-making, of pure cultures of ferments and pasteuri milk.

Bacillus Producing Red Pigment only on a Single Medium.‡ M. Didlake has isolated from the reservoir water of Lexington, K

* Centralbl. Bakt., 2te Abt., xv. (1905) p. 198.
† Ann. Inst. Pasteur, xix. (1905) p. 481.
‡ Centralbl. Bakt., 2te Abt., xv. (1905) p. 193.

tucky, a bacillus, 5 μ–8 μ long, 1·5 μ broad, that produces on Soy agar (a solid medium of agar added to an infusion made from the roots of the Soy bean with ½ p.c. saccharose and ¼ p.c. asparagin) a characteristic raspberry-red pigment that later acquires an iridescent lustre, but though growing, yet with difficulty, on other media such as ordinary agar, gelatin, potato, etc., no pigment production was observed on any occasion; in the reservoir water there is a faintly reddish growth forming a deposit. The organism is very actively motile, and retains this motility on Soy agar for 5–6 weeks, whereas on ordinary agar all motility is lost within a week; on ordinary media the bacilli become much distorted; spore formation was not observed; milk remained uncoagulated, and there was no production of acid or pigment; gelatin was not liquefied; in glucose media there was no production of gas. No reference is made as to the pathogenic action of this organism. Growth is most favoured by room temperature; incubation at 37° C. retards both growth and pigment production. An agar medium made by substituting an infusion of Alfalfa roots for that of the Soy bean roots behaved as ordinary nutrient agar medium, no red pigment being formed.

Tubercular Disease of Olive Trees..*—R. Schiff-Giorgini finds that the *Bacillus oleæ*, which produces this disease, is a motile aerobe, having many flagella, and forming spores. Primitive tubercles occasion the production of metastatic tubercles by the wandering of the active bacteria along the vessels. The bacillus extracts amylase which the plant hydrolyses by a further process. The infected plant protects itself from the action of the parasite by mechanical and chemical means, producing bast and cork at the seat of infection, and "Thyllen" in the invaded vessels; the sap of the living cells, within a certain distance from the seat of infection, acquires a lytic, agglutinative, and fatal action for the organism; this action is lost on boiling.

Bacterium Chlorometamorphicum.†—L. Macchiati isolated from a green deposit in a closed flask of distilled water an organism to which he has given the name *B. chlorometamorphicum*. It occurred as non-motile rods, 7 μ–10 μ long and 4 μ–5 μ broad; multiplied only by division: spore formation was never observed. If the aeration of the water is unfavourable, the bacillus appears in a coccal form. It stains readily with aqueous solutions of basic dyes. The author considers that the aerobic form of this bacillus occurs in the air, the anaerobic in the earth. He was unable to show that the green colour of the deposit was due to the organism.

Anaerobic Organism Resembling the Influenza Bacillus.‡—V. K. Russ observed short rods with bipolar staining, together with short streptococcal chains in pus obtained from an abscess in the buttock; aerobic and anaerobic cultures were made on blood-, serum-, glycerin-, and glucose-agar plates, and incubated at 37° C. The aerobic cultures gave negative results, but on the anaerobic glucose-agar plates after three days there appeared a number of very small round dew-drop-like

* Centralbl. Bakt., 2te Abt., xv. (1905) p. 200.
† Tom. cit., p. 268.
‡ Op. cit., Orig., xxxix. (1905) p. 357.

colonies, with finely granular, faintly yellow cupped centres, from whic fine streaks radiated to the clear and colourless periphery. The bacillu is a short rounded rod, in length about three times the breadth; in ol cultures it forms long unsegmented threads; it stains well with th ordinary aniline dyes, but not by Gram; it is not acid-fast; it ha molecular but no true motility, and no flagella could be demonstrated spore formation was not observed. No growth was obtained, eithe under aerobic or anaerobic conditions, in the usual fluid media, excep ing glucose broth, in which medium, under anaerobic conditions, granular deposit appears after three or four days, the medium itse remaining clear. Optimum temperature 30°–37° C. It was no pathogenic for mice.

Bacillus Renalis and the Pseudo-diphtheria Bacillus of Man.*—W. Ernst, in a note on *Pyelonephritis diphtheritica bovis* and the *Bacill renalis* observes the similarity of this organism to the pseudo-diphthei bacillus of man both in morphological and in cultural characters. Bo are non-motile aerobic bacteria with tendency to pleomorphism; culture there is no production of acid, or of indol; growth is especia good in neutral or slightly alkaline urine, urine agar, or urine brot guinea-pigs are unaffected after inoculation.

Flora of Malignant Growths.†—L. Karwacki has made cultivatic from a number of malignant growths and has isolated various organisı the cultural and staining characteristics of which he describes and co pares with those of the organisms that have been isolated from simi growths by other investigators. He has studied especially the stapl lococci and streptococci, and has noted the various results obtained w agglutination experiments made with different sera.

Anaerobic Bacteria producing Necrosis and Suppuration Cattle.‡—L. Roux refers to 27 cases of necrosis and suppuration amon cattle, and gives account of the organisms either present or isolated each case. He found aerobes, *B. coli communis*, *B. vulgaris*, and stre cocci, and anaerobes, *B. necrophorus* (*Actinomyces necrophorus*, Lehn and Neuman), spore-headed bacilli or pseudo-tetanus bacilli allied *B. putrificus coli* (Bienstock) and to *B. saprogenes carnis* (Salus), anaerobic variety of *B. pyogenes bovis* (Kunnemann), also a spirill Experimental necrosis was best obtained by inoculating a bacterium the aerobic group with one of the anaerobic group or a toxin of spore-headed bacillus, into the muscle of a pigeon.

Intestinal Streptococcus of the Horse.§—L. Baruchello foun saprophytic streptococcus in 92 examinations of the intestinal cont of 87 horses; he also isolated the same organism from a donkey. Ka broth was employed for purpose of isolation; the streptococcus st by the ordinary dyes but not by Gram; cultures were obtained on and glycerin-agar; on gelatin, which did not become liquefied; on se and on potato; milk was slowly coagulated; there was no produc of indol, nor gas in sugar media. It is a potential anaerobe;

* Centralbl. Bakt., Ref. 1te Abt., xxxvi. (1905) p. 148.
† Op. cit., Orig. 1te Abt., xxxix. (1905) p. 369.
‡ Tom. cit., p. 531. § Tom. cit., p. 569.

pathogenic for mice, and in strong doses also for guinea-pigs, its virulence being increased by repeated transmission through these animals; it has specific agglutinating properties, by which it may be differentiated from other streptococci. The author considers that it is commonly present in the intestine of the horse, that it is usually harmless, but that under certain conditions, either alone or in conjunction with *B. coli*, it becomes harmful and infects the animal.

Variety of Zoogleic Tuberculosis.*—J. Cagnetto describes a case of zoogleic tuberculosis attacking a guinea-pig, which showed many points of resemblance to the case of pseudo-glanders. At the autopsy purulent nodules of varying sizes were seen on the surface and in the depth of the liver and spleen, between the serous layers of the mesentery, and in the lungs. A film preparation made from the exudate, stained with Loeffler's blue, showed that the pus was composed of polymorphonuclear leucocytes, mononuclear cells, and lymphocytes, but no giant cells. Included in, but more often lying free between the cells, were large and small bacilli, some resembling cocci; these stain badly with Loeffler's blue; they had no tendency to form chains or threads. Cultures made from the pus in neutral pepton broth, soon became clouded at 35° C., and after 36 hours an iridescent pellicle was formed, which later sank as a grey flocculent deposit; the culture had no odour; in glucose, saccharose, and lactose broth there is a strong production of acid; there is no formation of indol. In gelatin stab cultures, small white colonies appear along the track, the medium not undergoing liquefaction, and no gas being formed. It grows slowly in milk without changing its reaction; after 6–8 days at 35° C. the liquid separates into a layer of serum and a flocculent portion of coagulated casein. On potato, by the second day, there appeared a moist grey growth that later assumed an orange-yellow colour. The chief morphological character of the organism is its pleomorphism, varying from coccal forms to round-ended rods 3μ long by $0 \cdot 7\mu$–$0 \cdot 9\mu$ broad, showing two and three vacuoles; the rods stain with ordinary dyes, but not by Gram; there is slight motility in hanging drop; no spores have been demonstrated; vitality and virulence are long retained in artificial media. It is pathogenic for pigeons and white mice, but especially for guinea-pigs, in which animals it produces an orchitis like that produced by the *B. mallei*.

The author considers that this organism does not belong to any of the three types of pseudo-tubercle bacilli as defined by Preisz, but should be regarded as a pseudo-glanders bacillus.

Observations on types of Bacillus Pestis.†—E. Klein has described two types of *Bacillus pestis* differing in morphological, cultural, and physiological characteristics. (1) The human type of cylindrical bacilli, very virulent for man and for rodents, and showing granular opaque colonies on gelatin. (2) The rat type of oval or coccal-like bacilli, with tendency to involution forms, showing translucent growth on gelatin, and having markedly less virulence for guinea-pigs and presumably also for man, and which rapidly lose their virulence on

* Ann. Inst. Pasteur, xix. (1905) p. 449.
† Local Gov. Board Supp. Medical Officer's Rep., 1903–4, p. 368.

artificial media. These two types do not otherwise differ, and bot produce plague in rodents. The author has shown that type (2) h been derived from type (1) by a series of passages through the rat, an that this attenuated variety of *Bacillus pestis* can be experimentall produced, and will breed true.

Direct Microscopic Preparation of Cheese.*—A. Rodella h applied the method devised by Gorini of making stained preparations fresh and also alcohol-hardened sections of cheese in various states ripeness, and which can be compared with the results of cultu experiments, to the examination of Emmenthal and Gorgonzola chees The author also makes impression preparations by pressing small p tions of cheese between two slightly warmed slides on which impressio of the cheese are left, and after removing the fat by chloroform a alcohol, can be stained and compared with the section preparatio He finds that bacteria are collected in colonies of varying sizes, whi are distributed irregularly throughout the cheese; occasionally th bacterial collections include several varieties of organisms; that intervals between the collections is usually not quite free from mic organisms.

Two New Pigment-producing Bacteria.†—S. v. Bazarewski scribes a bacillus and a coccus that produce pigment. *Bacillus brunn rigensis*, isolated from soil, is an oval motile rod $1 \cdot 7\mu$–$2 \cdot 5\,\mu$ long $0 \cdot 75\,\mu$ broad, with long flagella; it stains by the ordinary dyes but by Gram's method; spore production was not observed; in old cult capsules are formed; brown granular colonies are formed on gela which is completely liquefied within a week; the growth on agar is wh the condensation water is clouded and has a brown deposit, and in cultures the whole mass of the agar assumes a brown colour; brot clouded after two days at room temperature, showing a brown pell and later a brown deposit, the medium remaining alkaline; on po there is a yellow growth, which later together with the potato tak dark brown colour; milk remains unchanged; there is no produc of gas or indol; it is a potential anaerobe; optimum temperature 30° it is not pathogenic for white mice; the brown colour is soluble in w and alcohol, but insoluble in ether, and unchanged by concentr nitric acid.

Micrococcus citreus rigensis, isolated from the air of the laborat as round isolated cells $1 \cdot 2\mu$–$1 \cdot 5\,\mu$ diameter; stains by ordinary dyes, not by Gram's method; forms slow-growing sulphur-yellow colonie gelatin, which commence to liquefy after 10–14 days; on agar it f a sulphur-yellow growth, the condensation water remaining clear wi yellow deposit; on potato there is formed a slimy growth of a d yellow than the growth on gelatin, and the potato itself remains changed; milk remains unchanged; there was no production of gas or indol; it is a firm aerobe; optimum temperature 30° C.; pathogenic for white mice. The yellow pigment is insoluble in w alcohol, ether, chloroform, and benzine.

* Centralbl. Bakt., 2te Abt., xv. (1905) p. 143.
† Tom cit., p. 1.

Influence of Symbiosis on the Virulence of Pathogenic Microbes.* E. Klein finds that a culture of *B. typhosus*, which, in a certain dose, is not capable of living and multiplying in the peritoneal cavity of a guinea-pig, can be made to grow there, and to act virulently, if it be introduced into the animal symbiotically with either *B. enteriditis* of Gaertner, *B. coli* from ice cream, *B. enteriditis sporogenes*, or *B. carnis*; that *Vibrio choleræ* has its vitality and virulence enhanced by symbiotic introduction into a guinea-pig with *B. coli* from ice cream, or with *B. carnis*; and that a similar enhancing influence is exerted on *B. diphtheriæ* by *Streptococcus pyogenes*.

Loss of Nitrogen in Soils.†—P. Ehrenberg inoculated 100 c.cm. of pepton solution with 10 c.cm. of soils obtained from various sources. The flasks were incubated at 30° C. for eight days; the solutions were then filtered and the total nitrogen content compared with that of the inoculated solution before incubation. He finds that the apparent loss of nitrogen by the putrefaction of the pepton solution inoculated with soil, is explained rather as an absorptive action than as a biological consumption of the nitrogen.

KLEIN, E.—**Vitality of the Typhoid Bacillus in Shell-fish.**
Trans. Pathol. Soc., lvi. (1905) pp. 231–8.

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* Local Gov. Board Med. Officer's Rep., 1903–4, Supp., p. 431.
† Centralbl. Bakt., 2te Abt., xv. (1905) p. 154.

MICROSCOPY.

A. Instruments, Accessories, &c.*

(1) Stands.

Beck's New Portable Dissecting Microscope.† — This dissectin Microscope is made in a portable form, with all the necessary apparat packed into the thickness of the wood, so that when folded there are

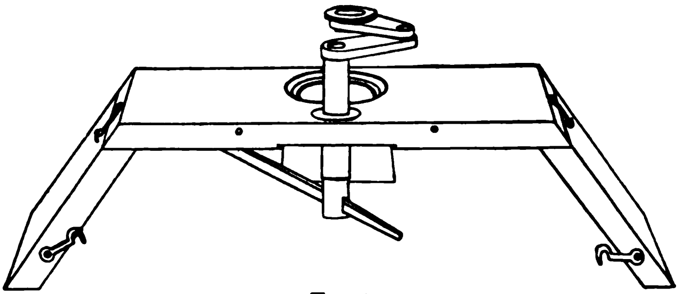


Fig. 1.

projections or loose pieces. The size when folded is 9 by 3¾ by 1⅛ Fig. 1 shows the instrument ready for use, and fig. 2 how it is hin and folded back when not in use. The table has a circular aperture the reception of a white porcelain saucer or a piece of transparent gl

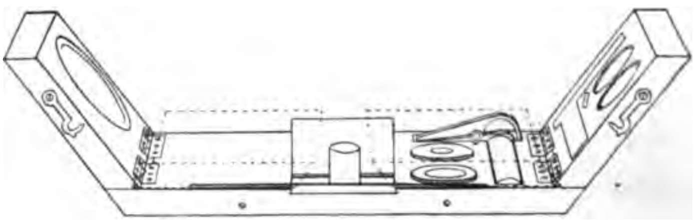


Fig. 2.

The lens carrier consists of a tube which fits into a socket in the t It has a double arm at the end of which the lens is fitted. At the l end of this is a lever, which forms a focusing adjustment.

* This subdivision contains (1) Stands; (2) Eye-pieces and Objective Illuminating and other Apparatus; (4) Photomicrography; (5) Microsc Optics and Manipulation; (6) Miscellaneous.

† R. and J. Beck's Special Catalogue, 1905.

Reichert's New Stand VII.*—This model (fig. 3) has a circular stage, and a bent arm which serves at the same time as a handle for carrying. There are the usual fittings and adjustments.

FIG. 3.

Reichert's New Handle Microscope.†—This stand (fig. 4) has an inclination of 45°, a large circular stage, and an extra large curved bar

* Reichert's Special Catalogue, 1905, p. 7.

† Tom. cit., p. 8.

which serves as a handle for carrying. There are the usual coarse a1
fine adjustments, and the accustomed substage fittings.

Fig. 4.

(3) Illuminating and other Apparatus.

Nernst-Paul Optical Electric Lantern.*—This compact and por lantern (fig. 5) is constructed entirely of metal, and may be connect any electricity supply system. It does not require any special pre tion or external appliances. It is specially adapted for travellin

* R. W. Paul's Special Catalogue, 1905.

the whole apparatus, ready for use, can be carried in one hand. The measurements of the case are 18 by 7 by 7 in., and the weight 15 lb.

FIG. 5.

Nernst-Paul High-power Electric Projector Lamp.*—This projector lamp (fig. 6), which is a high-power illuminant for the lantern, takes a current of about three amperes, and in the same lamp a burner

FIG. 6.

may be used suited either for direct or alternating current, or for pressures of 100, 200, or 250 volts, a different burner being required for each of the systems of supply.

Nernst-Paul Electric Science Lantern.†—This lantern (fig. 7) is adapted for horizontal or vertical projection, the whole apparatus being mounted on trunnions. When used for vertical projection the lantern is turned into the upright position, so that one reflector only is needed and brilliant illumination insured. The change from one position to the other is effected instantaneously. The metal stand has levelling

* R. W. Paul's Special Catalogue, 1905. † Op. cit.

feet and substantial clamps for fixing the lantern, the body of which
well as all the working parts, is of metal.

FIG. 7.

Adjustable Microscope Lamp.*—R. W. Paul exhibited at
November Meeting an adjustable Miscroscope lamp adapted fo

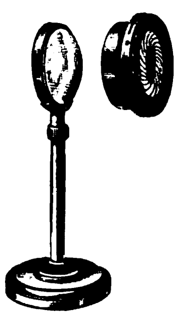
FIG. 8.

B-type Nernst lamp of any required voltage (fig. 8). It is readil
in place by means of the screw collar at the back of the lanter

* R. W. Paul's Special Catalogue, 1905.

latter has a double tubular body and a knob by which it may be handled. The feet of the tripod are drilled for screwing to the table, and are provided with leather pads. Glass tinters and a ground-glass screen are supplied, and these are fixed to the front of the lantern by means of clips.

Aitchison Photometer.*—This photometer is for measuring the loss of light by absorption and reflection in binoculars and telescopes. The instrument comprises, a lamp placed between two screens, the lamp being movable along a finely divided scale, and the screens are set at the extremes of a triangle, of which the scale forms the base. The other sides of the triangle converge upon the observation telescope, which consists of a triangular box with tubes projecting from each side. The tubes facing the screens carry object-glasses, while the third is arranged as an eye-piece. Two prisms are so arranged in the telescope that the light from each screen is made to illuminate half the field as seen in the eye-piece; the illumination of the field therefore varies according to the distance of the lamp from the screens. If a binocular or telescope be placed between one of the screens and the observation telescope, the light can be so moved that the two halves of the field are equally illuminated, and the loss of light is calculated by a reading from the scale.



FIGS. 9, 10.

Beck's Large Bull's-Eye Condensing Lens.—This is shown in fig. 9, on stand, with raising motion and clamp; the lens being over the centre of stand.

Beck's Iris Diaphragm.—This (fig. 10) is attachable to the above apparatus.

Sauver's Bridge Object Holder.—This consists of a bridge-shaped plate of metal which is placed on the stage of the Microscope (fig. 11). The

FIG. 11.

specimen is held by rubber bands so that its flat surface is held against the under-surface of the bridge, the hole therein allowing of its examination. It is made by R. & J. Beck.

(4) Photomicrography.

Portable Photomicrographic Camera.—This instrument (fig. 12), which was exhibited at the October Meeting, 1905, by E. Moffat, is suitable for travellers, and is only a few ounces in weight; it will pack up with travelling Microscope in case, and when placed horizontally is quite reliable with oil immersion lenses up to 1000 diameters. A is a telescopic tube, made in three lengths of 6 in. and of aluminium for lightness.

* Catalogue, Optical Convention, p. 230, fig. 1.

B, a plate with screw to fit into socket on lid of Microscope cas C, a square of $\frac{1}{2}$ in. mahogany with hole 3 by 3 in. in centre; D, tv small guides on each side of hole with stop to hold focusing screen a afterwards the dry plate when making the exposure; E, a cloth bag thin light-tight material, or black kid leather bellows with light stiffe ing; F, elastic band to grip around ocular. No dark slide is necessar

FIG. 12.

simply cover the plate when making exposure with an ordinary foc cloth of dead black material, which will be found quite sufficient for the finest work.

WHITE, T. CHARTERS—**Photomicrography as an Aid to Dental Research.**
Brit. Dental Journ., xxvi. (1905) pp. 1

(6) Miscellaneous.

Cinematograph and Microscopy.*—At a meeting of the Socie Arts, F. Martin Duncan showed examples of the successful applic of the cinematograph to microscopical investigation, illustratin

* Journ. Soc. Arts, liv. (1905) pp. 26–8.

circulation and rotation of protoplasm and the movement of the chlorophyll bodies within the cells of the leaf of *Elodea*; the circulation of the blood in the web of the frog's foot and in the tail of the goldfish. The lecturer also exhibited microbioscope pictures of *Hydra viridis*, various birds, beasts, and reptiles in motion, and of the life and work of the wood ant.

B. Technique.*

(1) Collecting Objects, including Culture Processes.

Endo's Fuchsin Agar.†—K. Fürntrat finds that when fuchsin solution has been decolorised by sodium sulphite, the colour can be restored by the addition of the smallest quantity of either a mineral or organic acid, but the colour can again be removed by a further addition of sodium sulphite or by excess of acid; the colour can also be restored by the addition of formalin, but can only be removed again by excess of sodium sulphite; the solution decolorised by sodium sulphite regains its colour on warming, but on cooling the colour is again lost; fuchsin solution is decolorised by a relatively large addition of acid, but if mineral acid is used the colour is not restored on heating.

Endo's medium consists of lactose nutrient agar coloured red with fuchsin, and to which sufficient sodium sulphite has been added to render it colourless when cool. On this medium the colonies formed by *B. typhosus* are small and colourless, whereas in the same period of time those formed by *B. coli* are large and of a deep red colour, which is diffused in the medium; after 15 hours growth these organisms may be differentiated. The author finds that single surface colonies of *B. typhosus* after 36 hours exhibit a faint pink colour, especially if the medium is more than two weeks old; that the colonies of *B. coli* and the surrounding medium begin to decolorise after 24 hours, and in the course of the next day all colour is lost, especially with grouped colonies, the isolated colonies retaining the red colour for a much longer time; the colonies of *B. coli* lose their colour more quickly if colonies of *B. typhosus* are grown simultaneously on the same plate.

The author applies the results of his observation on the chemistry of fuchsin to explain these bacteriological phenomena.

Modification of Endo's Medium.‡—W. Gaehtens has modified the fuchsin agar medium devised by Endo for the differentiation of *B. typhosus* and *B. coli* by the addition of caffein, which hinders the growth of *B. coli*. He gives full details of the method for preparing his medium. After many trials of various doses of caffein and of degrees of alkalinity, he finds that the addition of 0·33 p.c. of chemically pure crystalline kaffein to Endo's medium of an alkalinity of 1·5 p.c. normal sodium hydrate, (? + 1·5 N) serves best to considerably hinder

* This subdivision contains (1) Collecting Objects, including Culture Processes; (2) Preparing Objects; (3) Cutting, including Imbedding and Microtomes; (4) Staining and Injecting; (5) Mounting, including slides, preservative fluids, &c.; (6) Miscellaneous.

† Centralbl. Bakt. Orig., xxxix. (1905) p. 487.

‡ Tom. cit., p. 634.

the growth of *B. coli* without affecting the development of *B. typhosu*
and *B. paratyphosus.*

Electrically-controlled Low Temperature Incubator.* — L. A. Rogers has described the following arrangement for a low temperatur incubator. It is adapted from a small refrigerator (fig. 13) by putting in an insulating partition between the ice box and the lower chamber; a $\frac{5}{8}$ inch lead pipe C is coiled in the bottom of an ice box, and in th

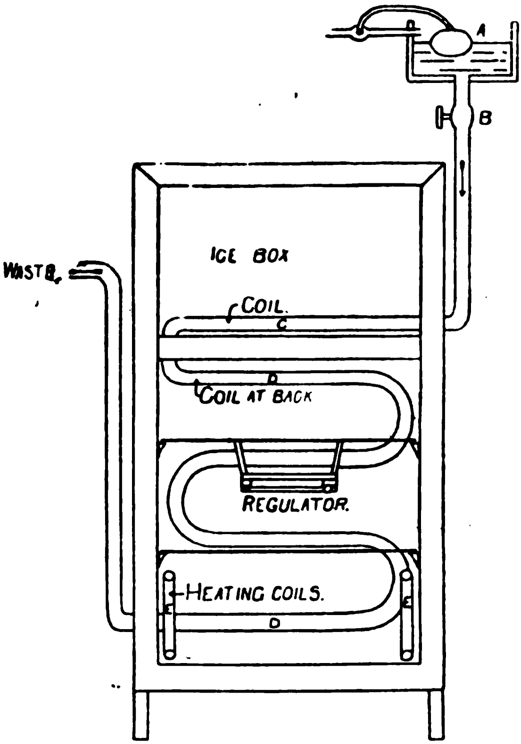


FIG. 13.

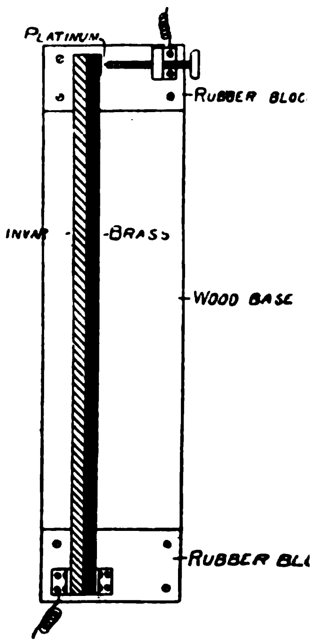


FIG. 14.

lower chamber D D; the ice rests on the coil C which is connected w a reservoir A containing a float valve, to insure a constant pressure; t other end of the pipe is connected with the waste. A slow current water through the coil will reduce the temperature of the lower cham below 20° C.; the temperature may then be raised and maintained any desired point by an electrical device. This consists of a resista coil for heating, a bimetallic regulator connected with a low volt circuit obtained from resistance coils, and a circuit-breaker operating heating circuit. The regulator is composed of two strips of brass a ivar (a nickel-steel alloy) each $\frac{1}{8}$ by $\frac{1}{2}$ by 15 inches, riveted together a

* Centralbl. Bakt., 2te Abt., xv. (1905) p. 236.

attached firmly at one end to a block of hard rubber (fig. 14), the other end moving freely over a similar hard rubber block, to which is fastened the screw closing the current; the adjustment of the temperature is secured by movement of the screw. The low voltage current is best obtained from a series of resistance units connected in a lighting circuit (fig. 15); a 32 c.p. lamp A connected in series with a number of coils of small iron wire, B B, answer the purpose. The circuit passes to the regulator C, then to the magnet of the circuit breaker D, and back to some point on the wire resistance, which is regulated by changing the connection H until it gives a current just sufficient to operate the magnet; the regulator should be so arranged that the heating circuit is closed when the magnet pulls the armature F up against the binding post E.

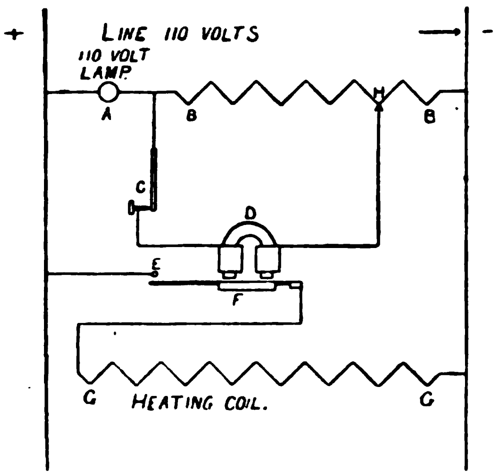


FIG. 15.

Observations on the Drigalski-Conradi Method of Diagnosing Typhoid Bacilli.*—Ed. Monti has shown that by means of the Drigalski-Conradi medium, or other chosen media, or even the agglutination reaction, a positive diagnosis of a typhoid-suspected colony cannot be assured. For on this media there grow different colonies which resemble typhoid bacilli and more or less agglutinate with typhoid serum; and, further, typhoid colonies can be found which agglutinate less actively than other species (Lipschütz, Klinger, etc.).

With our present knowledge of the biology of typhoid bacilli it is useless to hope to make a certain diagnosis in 16–20 hours, or even to separate and identify the specific organism from the fæces or urine. To control the suspected colony thoroughly necessitates 2–3 days.

Further, a negative result with the Drigalski media does not exclude the presence of typhoid.

The author could find the specific germ only in 5 out of 12 cases. His repeated negative results agree with those of Lipschütz, Krause,

* Archiv Sci. Med., xxix. No. 4. See also Centralbl. Bakt., xxxvii. (1905) p. 267.

and Stertz, who examined the fæces and urine, and of Fickers an Hoffmanns, who experimented with the natural fæces and also wit fæces mixed with typhoid bacilli.

The method therefore serves only as a useful confirmation in th hands of an experienced laboratory worker.

New Method for Differentiating Eberth's Bacillus from Pseudo-typhoid and Colon Bacilli.*—Trapani says that in neutral glyceri the growth of typhoid and other pathogenic organisms is inhibited whilst pseudo-typhoid and coli are uninfluenced. His method is as follows:—Typhoid, pseudo-typhoid, and colon bacilli are emulsified in distilled water and placed for one hour in the thermostat at 30° to destroy the clumps. Neutral glycerin tubes are then inoculated an incubated at room temperature, shaded from light, for 48 hours. Th two latter flourish prolifically, but the former grows either not at all o very sparsely, owing to the clumps not having been perfectly destroyed

Technique of the Gruber-Widal Reaction.†—Ernst Schottelin describes a simple and cheap means of obtaining blood for Widal's re-action. The blood is absorbed from the puncture on to a densely rolle gauze or sponge swab, which is fixed on to a glass or metal needle, whic in its turn is fastened to a cork or rubber stopper. This fits into a tub and prevents evaporation. The plasma is separated from the clot b centrifugalising, and removed with a pipette.

Glucose in Pneumococcus Cultures.‡—R. Turró finds that th presence of grape-sugar in liquid media is very conducive to the grow of pneumococcus. It is also inhibitory to other organisms, and may used in quantities of 8–10 p.c. Pure cultures may be obtained direct from sputum.

Caffein Enrichment Method.§—C. Birt draws the following in-ferences from his investigations on the action of cultivation media con-taining caffein:—(1) 0·5 p.c. caffein in 1 p.c. pepton water does n always restrain the development of the *B. coli communis*; (2) 0·5 p. caffein in 1 p.c. pepton water inhibited the growth of 26 out of races of *B. typhi abdominalis* examined; (3) 0·5 p.c. caffein in 1 p pepton water completely arrested the development of 18 varieties dysentery bacillus; (4) caffeinated media are of service in isolati streptococci and staphylococci; (5) Negative results with caffeinat media cannot be relied upon to exclude the presence of *B. typhi abd minalis* in water or dejecta.

SMITH, BERTRAM G.—**Collection and Preparation of Material for Classes Elementary Zoology.**
[An excellent and practical article; very useful for a course of element invertebrate zoology.] *American Naturalist*, xxxix. (19 pp. 779–89 (1

* Gaz. Osped. Clin., 1905, No. 58. See also Centralbl. Bakt., 1te Abt., xxx (1905) p. 268.

† Münch Med. Wochenschr., 1905, No. 15. See also Centralbl. Bakt., 1te A xxxvii. (1905) p. 268.

‡ Journ. Physiol. et Pathol. gén., vi. (1904) pp. 718–19.

§ Brit. Med. Journ. (1905) ii. pp. 1110–11.

(2) Preparing Objects.

Fixing and Staining the Goblet Cells in the Epidermis of Fishes.*—M. Oxner found that only two fixatives gave good results. These were Apáthy's (equal parts of a saturated solution of sublimate in ½ p.c. sodium chloride and 1 p.c. osmic acid) and Johnson's (in the same proportions as used for the Golgi reaction, but without the platinum chloride). The fixing time was from 15–24 hours. The material was cleared up in chloroform, cedar-wood oil, or xylol. The sections were stained with iron-hæmatoxylin, hæmatein IA, and after-stained with acid rubin, orange G, orcein, light green S.F., or with erythrosin, saturated aqueous solution of kreso-fuchsin, with subsequent differentiation in picric acid. Acid rubin was found to be very effective. Victoria blue stained the goblet-cells dark blue, the rest of the tissue being unaffected.

Apáthy's gold method, alcoholic safranin, Apáthy's rubin S, were also of much service.

Demonstrating the Heart and Arteries of Rhipidoglossa and Docoglossa.†—J. Spillmann fixed most of the animals in aqueous or alcoholic solution of sublimate. For the heart muscle Flemming's fluid and osmic acid were used with good result. Picro-acetic (saturated solution picric acid and glacial acetic acid in equal parts) was employed for fixing the kidney. Owing to the brittleness of the material, difficulties were experienced with the paraffin imbedding, but these were obviated by using cedar-wood oil instead of xylol. At first the sections were stuck on the slide with glycerin-albumen, but this method was afterwards superseded by warm water. The preparations were dried (? incubated) for 2 days, and then coated with a thin layer of collodion.

The best stain was iron-hæmatoxylin, but Böhmer's and Delafield's hæmatoxylin were also used. Safranin was employed for detecting nuclear fission in the pericardiac glands.

Demonstrating Spermatogenesis of Scolopendra heros.‡—M. W. Blackman, when studying the spermatogenesis of *Scolopendra heros*, fixed the material with Flemming's chrom-osmic-acetic mixture or with Gilson's nitric-acetic-sublimate. The latter gave the better results. After a fixation of from 48–60 hours the objects were washed for several hours in running water, and then dehydrated in graded alcohols. The combined celloidin and paraffin method of imbedding was used. The sections made with the Minot microtome were fixed to the slide with albumen. The paraffin was then removed, and in some cases the celloidin also. The sections were stained with Heidenhain's hæmatoxylin, either alone or in conjunction with Congo red. Other stains used were Bismarck brown, cyanin, methyl-green, methyl-green-acid-fuchsin, Flemming's tricolour stain, and others.

(3) Cutting, including Imbedding and Microtomes.

Acetone-celloidin Method of Rapid Imbedding.§—F. Scholz places pieces not thicker than 3 mm. in pure acetone for half an hour. They

* Jena Zeitschr. Natur., xl. (1905) pp. 589–646 (5 pls.).
† Tom. cit., pp. 537–88 (3 pls.).
‡ Bull. Mus. Comp. Zool. Harvard, xlviii. (1905) 138 pp., 9 pls.
§ Deutsch. med. Wochenschr., xxxi. (1905) pp. 419–20.

may then be transferred to celloidin, though it may be necessary to pass certain material through alcohol-ether for 15 minutes. The pieces remain in a thin celloidin solution for 4–5 hours, at 37°–40°. They are then transferred to a thicker solution for 2–3 hours, after which they are placed in thick celloidin. In the last condition they are submitted to the action of chloroform vapour in a closed vessel. In about 14 hours they will be of the consistence of cartilage. The blocks are next further hardened in alcohol for some hours.

Using a Lathe as a Microtome.*—Having a few micro-sections to cut, and being in possession of a small lathe, W. Gribben made the fixture shown in figs. 16 and 17, which enabled him to hold in the slide-rest the razor. By locking the lathe-spindle, to prevent its rotation, the

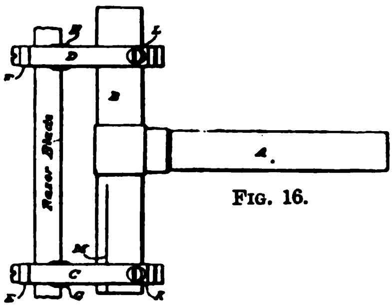


FIG. 16.

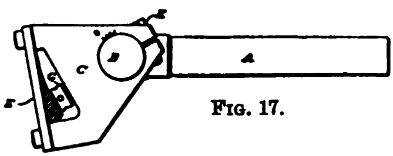


FIG. 17.

object to be cut could be held in a chuck, while the cross-slide of th rest was used to give the cut, and the longitudinal slide to give the feed Both screws of the slide-rest were provided with micrometers reading t 0·001 in., but the cross-slide screw was removed during the cutting t give a more rapid cut.

The fixture, shown in figs. 16 and 17, is made of two steel bars A and B, riveted together, and the two pieces of ¼-in. sheet-brass C and D, which have each a cavity cut out to admit the razor-blade, a shown in section in fig. 17. The flat steel bars E and F are screwe fast to C and D, and the flat side of the razor-blade is held firml against E and F, by the two capstan-head screws G and H bearing o the concave side of the blade. C and D are held on the round part of by the two pinching screws K and L, and by loosening these screws C and D may be swivelled around B, as a centre to alter the clearanc angle of the razor. C is graduated into spaces of 5° from 0°–30°, tl graduations being read by means of the straight line M scratched on I

* Optical Instrument Monthly, i. (1905) pp. 13–14 (3 figs.).

C and D are so shaped that when the clearance angle is 10°, the cutting edge of the blade is approximately in line with the centre line of A.

The fixture described above was all the author had to make for microtome work. The slide-rest was already provided with a boring-tool holder, which is a cast-iron fixture fitting the slide-rest in place of the usual tool-post, and having a ½-in. round hole in it, parallel with the upper slide, and at the same height as the lathe-spindle. This hole is split on one side, and has pinching screws to close the split and clamp the round boring tools securely on the round shank A of the razor-holder. This arrangement admits of turning A on the boring-tool holder, so as to bring the razor edge vertical to give a straight cut, or with an oblique edge to give a drawing cut. C and D may be moved along to different parts of B in order to bring different parts of the cutting-edge into action. When necessary to loosen C and D, this is

FIG. 18.

done while the razor is clamped in place, so that C and D will be properly located in regard to each other.

This fixture in conjunction with a lathe makes a fairly good microtome, if the requirements are not too exacting, as it cannot be used for the best or for riband work.

Triepel's Cylinder-Rotation Microtome.*—This has been designed by H. Triepel, and is made by the firm of G. Miehe, of Hildesheim. It is shown in fig. 19 one-third of the full size. A strong-walled hollow cylinder, 107 mm. external diameter, is firmly connected with a base-plate. The cylinder is supported on three uprights, and within it is a second hollow steel cylinder, 115 mm. in height and 80 mm. in external diameter. Its upper and lower ends are both closed by brass plates. To the under plate a small disk of hardened steel is screwed on, by means of which the inner cylinder rests on the micrometer screw. The steel cap of the screw is also hardened. The raising arrangement is of the usual kind. Rotation through the space of one tooth raises the cylinder 2 μ. The object-holder is secured on the upper plate of the inner cylinder.

* Zeitschr. wiss. Mikrosk., xxii. (1905) pp. 118–25 (3 figs.).

In section-cutting the cylinder with object is rotated, whilst the knife remains motionless. The knife is fastened on a massive four-sided prism, which is somewhat reduced at the upper end. This prism is 23 cm. high, and stands on the right-hand side of the cylinder, somewhat behind the horizontal middle line. On its front side the prism carries the bearing in which the axis of the winch rotates. On the left hand of the axis there is a toothed wheel, made of vulcanite, whose cogs engage in vertical flutes which are fitted on a projection of the upper plate of the inner cylinder, and which reach, collar-like, over the outer cylinder. Rotation of the winch causes a translation movement

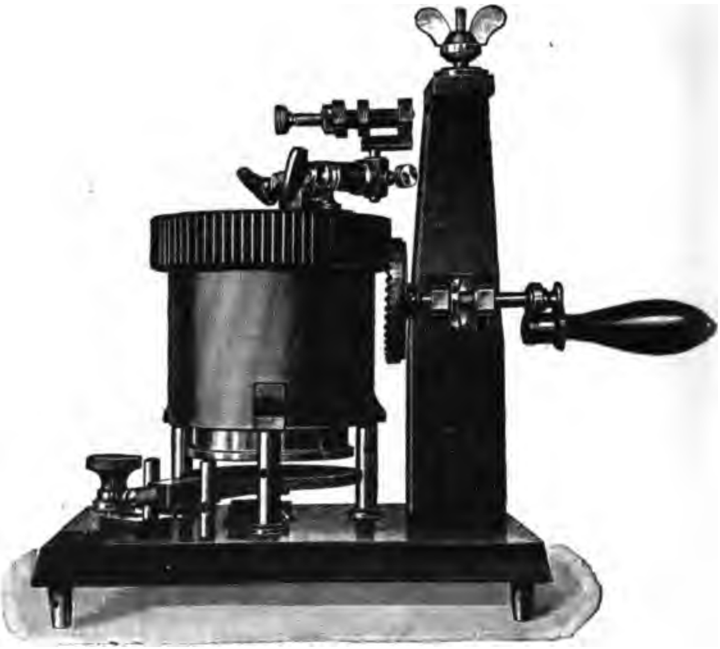


FIG. 19.

of the cylinder in the ratio of 2 : 1. The object-holder is so arranged that it can be set once for all at a certain distance from the cylinder axis. After the cutting of a section, further rotation of the winch in the same direction brings the object-holder into position for the next section. The application of a lubricant is superfluous, or only necessary after very long use of the instrument. It is to be noted that the object is moved with accurate perpendicularity against the knife-edge. The knife can also be arranged for oblique sections. The accuracy of the section-cutting is stated to be remarkable, and approximates very closely to theory. The absence of oil-layers removes a difficulty met with in many microtomes, and this improvement was a great consideration with the inventor.

(4) Staining and Injecting.

Staining Spirochæta pallida.* — K. Reitmann advises fixing the film in absolute alcohol for 10 minutes, and, after washing in distilled water, mordanting for 5 minutes in 2 p.c. phospho-molybdic acid. After washing with 70 p.c. alcohol and distilled water, the film is stained with hot carbol-fuchsin. The preparation is then treated in the usual way.

G. Giemsa recommends that 1–10 drops of a 1 : 1000 solution of potassium carbonate should be added to the water before it is mixed with the staining solution. The stain should be allowed to act for from 15–60 minutes.

K. Herxheimer and H. Hübner stained films with a filtered aqueous solution of Nile blue B. R. (1 : 1000) for from 16–24 hours. The *Spirochætæ* stained dark blue. When treated with Capri blue (1 : 1000) the *Spirochætæ* were grey.

M. Oppenheim and O. Sachs stained films without any preliminary fixation, with hot carbol-gentian-violet solution (5 p.c. carbolic acid to 10 p.c. alcoholic solution of gentian-violet). The films were then washed and dried. The *Spirochætæ* are blue, and seem thicker than when treated by other methods.

Staining Neurofibrils.†—By use of Bielschowsky's method of reducing the ammoniacal silver with acetic acid,‡ which he says is less complicated and more certain than Ramon y Cajal's method, Wolff claims to show that the "contiguity but not continuity" view of the nerve dendrites is not supported. The dendrites are merely peculiarly differentiated sensory terminals in which there is not the slightest discontinuity of neuroplasm or fibrils to be demonstrated. Successful results are conditional on minute care. Method :—

1. Fixation in 6–10 p.c. neutral formalin. Wolff has got good results with weak acid reacting formalin. Previous treatment with Flemming's solution, Müller, etc., does not matter if carefully washed out for several days with distilled water.
2. Wash out thoroughly with distilled water. The pieces should not be more than 2 mm. thick. Sections are best cut on the freezing microtome, but may be silvered *en bloc*, or imbedded in paraffin and the cut sections silvered.
3. Preparatory silvering. The sections, block or paraffin cut sections, placed in 2 p.c. $AgNO_3$ solution in dark for two or more days.
4. Wash for few minutes.
5. Characteristic silvering. To 10 p.c. silver nitrate is added 40 p.c. caustic soda, drop by drop, until no further grey-brown precipitate appears. This precipitate is then dissolved in as little ammonia as possible, and diluted with 4 or 5 times its volume of distilled water (to be made fresh and used with horn needles and instruments only). In ½–2 or more hours the yellow tone changes to a more or less deep red brown.
6. Wash in distilled water for short time to remove excess of silver.

* Deutsche med. Wochenschr., 1905. See also Centralbl. Bakt., 1te Abt. Ref. xxxvii. (1905) pp 507–8.
† Biol. Centralbl., xxv. (1905) pp. 679–687.
‡ Journ. Psychol. u. Neurol., 1905.

7. Treatment with acetic acid: 5 drops in 10 cm. distilled water: only until red-brown colour changes to yellow.

8. Reduction in 4–5 p.c. formalin of the more firmly combined silver (i.e. with the neurofibrils). Control under low magnification until the nuclei appear unstained on a brown and black background. Failure is denoted by nuclei more or less blackened and Nissl's spindles in the cytoplasm. It is impossible to exactly control reduction in blocks, which take from 1–6 hours according to size. A small piece of the margin should be teased and examined.

8A. Imbed in paraffin with melting point of 45°–50°.

9. Fixation of the silver picture: All sections obtained in any way and treated as above are washed in tap water for 1–2 hours, and placed in a faint yellow watery gold chloride solution (1–0·5 p.c.), neutralised with lithium carbonate. The groundwork varies with the reaction of the gold solution, red if acid, faint blue if alkaline or neutral, whilst the impregnated fibrils are deep reddish violet or dark blue.

10. Wash for a short time in tap water, then in 5 p.c. sodium carbonate for 5–15 minutes, and finally in tap water for 6–12 hours with frequent changing.

11. Dehydrate; clear in xylol. Mount in balsam without applying any heat.

Note.—If the neurofibrils do not stain by this method, the tissue is not spoilt for other staining methods.

Staining of Spirochæta vel Spironema Pallida.*—El. Metchnikow and Em. Roux remark that too much importance should not be attached to the tint assumed by the *Spirochæta pallida* when stained by Giemsa's method, nor to the number of turns of the spiral. They accept the view that the *Spirochæta* of Schaudinn is the cause of syphilis, and regard the disease as a chronic spirillosis with relapses.

It has been recently suggested to alter the name to *Spironema pallida*, on account of the numerous differences between the microbe of syphilis and true *Spirochætæ*, such as *plicatilis* and *refringens*.

Demonstrating the Parasites of Smallpox.†—Siegel recommends a mixture of 7 parts of eosin (1 : 15000), and 1 part of Giemsa's azur ii (1 : 1000) for staining Guarnieri's bodies. The sections are left in the mixture for 2 hours, and are then mounted in balsam. The parasites are extremely small, and sporulate in the cytoplasm, a point which distinguishes them from the sporozoon of foot-and-mouth disease, which sporulates in the nucleus.

AMBRONN, H.—**Ueber pleochroitische Silber-Kristalle und die Färbung mit Metallen.**

[With suitable treatment, anistropic and pleochroic crystals are formed from solutions of silver nitrate; hence there exists a labile form of silver the crystals of which do not belong to the regular, but to another (possibly the rhombic) system.] *Zeitschr. wiss. Mikrosk.*, xxii. (1905) pp. 349–5

HEIDENHAIN, M.—**Ueber die Massenfärbung Mikroskopischer Schnitte auf Glimmerplatten.**

[Treats of the author's method of staining numerous sections on mica plates for class purposes.] *Tom. cit.*, pp. 330–6 (2 figs.

* Ann. Inst. Pasteur, xix. (1905) pp. 673–98 (2 figs.)

† Abhandl. k. Preuss. Akad. Berlin, 1905. See also Brit. Med. Journ. (190 ii. Epit. 260.

(5) Mounting, including Slides, Preservative Fluids, &c.

Parallel Brass Rings.—A series of six parallel brass rings, for mounting specimens parallel with plasticin, is shown in fig. 20. The specimen is laid flat surface downwards on a plate of glass or other

FIG. 20.

flat surface, and a ring somewhat deeper than the specimen placed around it. A 3 by 1 in. glass slip with a small piece of plasticin is then pressed upon the specimen till it touches the brass ring. The rings are made by R. and J. Beck.

(6) Miscellaneous.

New Method of Obtaining Anti-Bodies.*—E. Loeffler recommends, after many years extensive research, that the specific material (albumen, blood, bacteria, or tumour) be heated to dryness at a temperature sufficiently sustained to kill all living matter without injuring the anti-bodies' activity, and then powdered and inoculated into animals. Fowl albumen, blood, and spore-bearing bacteria are heated for half-an-hour at 150°, non spore-bearing bacteria for 2–3 hours at 120°. Albumen- and blood-precipitins, agglutinins, bactericidal and bacteriolytic material, were thus obtained. A similarly obtained mammary carcinoma serum (asses' serum) precipitated not only carcinoma cells, but also normal gland-cells; and, further, its inoculation into cachectic patients produced a visible improvement of the general condition and a local reaction, but without any retrogression of the malady.

Methods of Microscopical Research: Vegetable Histology.†—This work, by Abraham Flatters, is of inestimable value to the student of practical botany. It is no mere compilation of untried methods, but bears throughout the impress of experience. The author has selected for description a few, but yet sufficient, methods which in his hands have proved successful, and adequate attention is given to the technical minutiæ on which good results so much depend; thus saving the student who follows out the instructions much tentative labour and bad results.

The first part deals with technique generally applicable. After mentioning the importance of collecting specimens at proper times and under suitable conditions, the author dwells at some length on the methods of fixation, the object of which is "to preserve dead tissues in as nearly as possible their natural conditions in the living state." And to emphasise still further this important preliminary to all satisfactory and correct work, two illustrations show the marked contrast between good and bad fixation.

Chapter II. treats of apparatus and methods of work. The author's

* Deutsche med. Wochenschr., 1904, No. 52. See also Centralbl. Bakt., 1te Abt., xxxvii. (1905) p. 265.

† London and Manchester: Sherratt and Hughes (1905) 4to, x. and 116 pp., 23 pls. and 29 figs.

microtome, ingenious and simple, with its ready method of calculating the thickness of sections, is illustrated and described in detail even to the often difficult setting of the knife. Terse but adequate instructions for imbedding in paraffin and celloidin are given, and the art of cutting sections in three planes, viz. transversely, radial-longitudinally, and tangential-longitudinally, in order to obtain a solid picture, illustrated.

"Staining consists in differentiating the various composing tissues . . . and is governed by the chemical affinities of tissues which vary with age." With this introduction the art of staining is explained, and in Chapter III., instead of a bewildering list of innumerable stains, 13 stains and counter-stains are described, with their formulæ and full details for manipulation—"a list which is very limited, but one which will be found sufficiently extensive for the general worker."

The technique is completed by formulæ of mounting media and cements, and illustrated descriptions of mounting cells and an ingenious turntable for ringing ovals.

Chapter IV. systematically deals with type preparations selected to show plant structure from root to flower, including the growing cell and its contents, and every preparation has its corresponding illustration in the plates.

These plates still further enhance the value of the text, and consist of 100 beautifully coloured microphotographs specially prepared for this work. One misprint occurs in the text of fig. 35 (7).

When we recall the pitfalls of laboratory work and the days when tissues were cut by hand, held in a piece of pith, and the attempts at elucidating sections, which varied considerably with the operator's skill, by the aid of text or diagrams, we can only put down this work in full agreement with the author's prefatory remark that "had such a work been at my disposal twenty years ago, I feel sure that I should have been spared years of persistent hard work and many disappointments."

Clinical Diagnostic Bacteriology.*—A. C. Coles' work on the blood is so much appreciated that his recent excursion into bacteriology insures a respectful consideration. After dealing with technique, the author treats of the various acid-fast bacteria in respect of their morphological characters and their degree of resistance to acid, alcohol, and other decolorisers, and then describes his method of differentiating the tubercle bacillus from all other acid-fast tubercle organisms. The method amounts to this: stain with hot carbol fuchsin for about 7 minutes, and decolorise for about 4 hours or more in Pappenheim's solution, or the author's modification thereof, or in 25 p.c. sulphuric acid for 16–24 hours.

Other organisms treated of are the Gonococcus, Ducrey's bacillus, Pneumococcus, the microbes of influenza, meningitis, diphtheria, plague, actinomycosis, anthrax, relapsing fever, and parasitic fungi affecting the skin and hair. The last 20 pages are devoted to serum and cyto-diagnosis. Most of the work is given up to discussion on the acid-fast and more or less acid-fast red staining bacteria, about which the author gives evidence of much practical knowledge and experience. The work will be found to be extremely helpful to those who are anxious to obtain an insight into the difficult questions discussed and explained.

* London: J. and A. Churchill, 1904, viii. and 237 pp., 2 col. pls.

Nature through Microscope and Camera.*—This admirable introduction to the marvels of microscopy and photomicrography is the work of R. Kerr and A. E. Smith, the former contributing the descriptive portion, and the latter being responsible for the illustrations and the chapter on photomicrography. There are two Introductions, one by Professor Sims Woodhead, the other by the author. In the latter Mr. Kerr wisely remarks, that the more our young men take up intellectual pastimes the better it will be for the nation. After discussing the illustrations and high possibilities with the Microscope, and giving practical hints on photomicrography, the rest of the volume is devoted to describing and illustrating Radiolaria, Foraminifera, Insecta, Diatoms, botanical specimens; human hair, skin, bone, muscle, lung, and blood; mites, bacteria, hooklets of tapeworm, and silk.

Most of the illustrations are extremely good, but exception must be taken to Plates 47 and 51, which do not fairly represent the human skin or the blood-corpuscles. The former gives only a rough idea of structure, and the latter shows an early stage of degeneration. Notwithstanding such trivial blemishes, the work must be described as being admirable in respect of general get-up, description, and illustration.

Bacteriological Technique.† — "Bacteria in Relation to Plant Diseases," by Erwin F. Smith, is a notable example of how thoroughly the American Government appreciates the value of scientific work.

The first volume, which deals with methods of work and general literature of Bacteriology, exclusive of plant diseases, is one of the most complete and practical treatises that have been published on bacteriological technique. It would be beyond the limits of our space to enumerate even the outline of methods of work as given in this volume. It must suffice to say that every aspect of a bacteriological examination has been considered, and every phase of the routine of laboratory work mapped out in such a way that almost a neophyte could, with the aid of this text-book, conduct a bacteriological inquiry with hope of success.

The volume is copiously illustrated, and the bibliography extensive.

Methods in Plant Histology.‡—This work, the first edition of which was noticed in this Journal, 1901, p. 604, has been much improved and augmented by the author, C. J. Chamberlain. More attention has been given to collecting material, and the chapters on the paraffin and Venetian turpentine methods have been revised and much enlarged. Other new chapters deal with micro-chemical tests, freehand sections, special methods, and the use of the Microscope. This volume, which is half as large again as its predecessor, should be highly esteemed by botanists.

Dreyer, G., & Jex-Blake, A. J.—**On the Agglutination of Bacteria.**
Mém. Acad. Roy. Sci. et Let. Danemark, i. (1905) pp. 219–60.

Richter, O.—**Die Fortschritte der botanischen Mikrochemie seit Zimmermanns "Botanischer Mikrotechnik."**
[An exhaustive review of the progress in vegetable microchemical technique, to which is appended a very copious bibliography.]
Zeitschr. wiss. Mikrosk., xxii. (1905) pp. 369–411.

* London: Religious Tract Society, 1905, 194 pp., 65 pls.
† Carnegie Institution, Washington, D.C., U.S.A., Publication No. 27 (1905) 4to, 285 pp., 31 pls. and 146 figs.).
‡ Univ. of Chicago Press, 2nd ed., 1905, x. and 262 pp., 87 figs.

Metallography, etc.

The Quenching of Steel.*—Semozay gives a lengthy account of hi[s] investigations into the effect upon the hardness of steel and the position o[f] the critical range, caused by varying the conditions of quenching, such a[s] temperature, duration of heating, rapidity of cooling, and dimensions o[f] the mass quenched. Hardness was measured by the Brinell method. The critical temperatures were determined by taking cooling and heating curves, the junction of the thermocouple being inserted in a central hole. In the first series of experiments the samples (40 mm. by 10 mm. by 10 mm.) were heated in an electric furnace to the required temperature, and quenched. In the second series the steel was heated to a temperature above the critical range, cooled slowly to the required temperature, and quenched. Curves showing the relation between quenching temperature, and hardness are given. In the third series the length of time during which the steel had to be maintained at a given temperature to produce the same degree of hardness on quenching was determined. In the experiments upon the effect of variation in the size of the specimen, heating was carried out in a lead bath of large capacity. The steel was quenched in air, in oil, or in water. The author gives his conclusions at considerable length. A notable omission from the data given is the analysis of the steels employed in this research.

Corrosion Grooves in Boiler Plate.†—C. Frémont and F. Osmond point out that the existence of local corrosions in boilers can only be accounted for by irregularities either in original structure or resulting from conditions of construction or service. Corrosions have been classified according to form, (1) in spots ("pustulaire"); (2) in grooves. The former are probably due to original non-homogeneity of the metal such as inclusions of slag, sulphides, etc. It might be supposed that the mechanical stresses to which a boiler is subjected when in service cause local strains which lead to irregular oxidation. The authors show how maximum stresses are localised at certain points and lines owing to the method of construction of a boiler. It is along these lines that corrosion grooves are found. The authors advance arguments which tend to show that strain effects in the metal do not account for the grooves. A much more probable explanation is that the plate first becomes covered with [a] layer of oxide; this oxide is not deformable, i.e. is brittle, and th[e] slight elastic bending of the plate causes the oxide to crack along th[e] line of maximum stress. A clean surface of steel is thus exposed, an[d] oxidation goes on more rapidly. The small corrosion groove thus set u[p] is a line of weakness: stresses are still more localised along it, th[e] re-formed oxide is cracked, again exposing a line of bright metal f[or] oxidation. Corrosion grooves are much more dangerous in plates [of] poor quality than in good material. The authors give an account of th[e] investigations, carried out on four old locomotive boilers, which led [to] the above conclusions, and illustrate their paper with a number of phot[o]micrographs.

* Rev. Metallurgie, ii. (1905) pp. 737–74 (46 figs.).
† Tom. cit., pp. 775–88 (25 figs.).

Effect of Chromium in Steel.*—F. Osmond criticises Carpenter's statement that chromium does not confer upon steel the property of being self-hardening.† After re-stating his former results which led to the opposite conclusion, the author points out that the temperature to which his chromium steels were heated when the self-hardening effect was obtained, was considerably higher than that employed by Carpenter. Either this fact, or a difference in the rate of cooling, may account for the discrepancy in the conclusions reached by Carpenter and the author.

Mechanical Properties of Single Crystals of Iron.‡—F. Osmond and C. Frémont obtained some iron in abnormally large crystals, from an old steel rail which had been in use as a guide for a damper in a furnace-flue for 15 years, and had thus been subjected to thermal conditions favourable to the development of crystallisation. The metal contained 0·06 p.c. carbon. A tensile test-piece was obtained, the effective portion of which was constituted almost entirely by two crystals. Two compression test-pieces were cut from a single crystal. Stress-strain diagrams are given. Brinell hardness-tests were made on different faces of a crystal, giving somewhat different results. Statical bending and shock tests showed that the angle made by the cleavage-plane with the axis of the test-piece had great influence on the results, and that brittleness only appeared under impact.

Nickel-Manganese Steels.§—Having completed a general investigation of the ternary steels (alloys of iron, carbon, and a third element), L. Guillet has taken up the study of the quaternary alloys, starting with nickel-manganese steels. Assuming the possibility of deducing their properties from those of nickel steels and manganese steels, the author gives equations from which the constitution (whether pearlitic, martensitic, or containing γ-iron) of a steel of given analysis, may be calculated. Three series of alloys were prepared, the first containing 0·15 p.c. carbon, nickel 2 p.c., 12 p.c., or 30 p.c., manganese 5 p.c., 7 p.c., or 15 p.c.; the second containing 0·75 p.c. carbon, nickel and manganese both varying as in the first series. The members of the third series have analyses which cause them to be placed on the limit of two groups. Certain of the alloys could not be rolled. As in the author's former researches, the alloys were examined micrographically and mechanically in three states: (1) as forged (or normalised by slow cooling from 900° C.); (2) quenched; (3) annealed. Numerous tables of the results of tensile, shock, and hardness-tests are given. As in nickel steels, etc., alloys containing γ-iron are transformed by cold working, the γ-iron changing to martensite in a greater or smaller degree. Similar effects result from cooling in liquid air. The author considers that his deductions as to the constitution and properties of these alloys, taking the properties of the nickel steels and the manganese steels as data, are fully borne out by the results of his experimental work. Nickel-manganese steels may for many purposes replace nickel steels.

* Rev. Metallurgie, ii. (1905) pp. 798–9.
† See this Journal, 1905, p. 776.
‡ Rev. Metallurgie, ii. (1905) pp. 801–10 (12 figs.).
§ Tom. cit., pp. 825–41 (1 diagram, 20 photomicrographs).

Papers read at the Metallurgical Congress, Liége.*—L. Descroix gives a summary of these papers and the discussion which followed their reading.

"*Effect of Liquid Air Temperature upon Iron, etc.*"—A further contribution by R. A. Hadfield to the study of this subject.†

"*Influence of Titanium upon Cast Iron and Steel.*"—P. Delville gives an account of the work of previous investigators, and describes his experiments in which titanium thermit (a mixture of oxides of iron and titanium with aluminium) was added to liquid metal in the ladle. The oxides are reduced, titanium passing into the metal, the temperature of which is raised by the reaction. Blowholes are diminished and sounder castings obtained. The effect on the chemical composition of the steel is slight; mechanical tests appear to be somewhat improved. A notable result of the addition is the elimination of nitrogen, which passes into the slag as cyanide. The presence of some form of carbon favours this reaction.

"*Influence of Arsenic on Cast Iron and Steel.*"—P. Delville concludes that arsenic resembles sulphur in its effect upon iron and steel. In basic steel 2 As+S should not exceed 0·1 p.c.

"*Technique of Microscopic Metallography*"; "*Metallographical Examination of Iron and Steel.*"—The first of these articles by H. le Chatelier has been noticed previously.‡ In the second the author points out the value of metallography to the metallurgical industry. In steel of good quality very little can be seen by microscopical examination. It is in defective metal that the most definite structures are developed.

"*Special Steels*"; "*Metallic Alloys.*"—Two papers by L. Guillet summarising his extensive researches.

ARTH, G., AND LEJEUNE, P.—**Sur un métal préhistorique trouvé dans les environs de Nancy.**
[Analysis, photomicrographs, etc., of a mass of steel weighing about 300 kg. found in the earth. Carbon 1·2 p.c., silicon 1·7 p.c.]
Rev. Metallurgie, ii. (1905) pp. 789–92 (4 figs.)

ARNOLD, J. O.—**Steel as an Igneous Rock.**
Iron and Steel Mag., x. (1905) pp. 408–1[illegible]

BEILBY, G. T.—**Crystalline and amorphous states of metals.**
Tom. cit. pp. 419–2[illegible]

GUILLET, L.—**A practical and scientific study of the properties of bronzes, brasses and special copper alloys.** *Eng. Mag.*, xxix. (1905) pp. 940–[illegible]

PORLIER, A.—**Sur la composition d'un boulet en fonte des fossés de la Bastille.**
Rev. Metallurgie, ii. (1905) pp. 793–4 (1 fig.

PRICE, M.—**Frictional characteristics of bearing metal and their relation to microstructure.** *Eng. Mag.*, xxix. (1905) pp. 592–

* Rev. Metallurgie, ii. (1905) pp. 846–58.
† See this Journal, 1905, p. 775.
‡ Tom. cit., p. 669.

PROCEEDINGS OF THE SOCIETY.

MEETING

HELD ON THE 20TH OF DECEMBER, 1905, AT 20 HANOVER SQUARE, W.
DR. D. H. SCOTT, F.R.S., ETC., PRESIDENT, IN THE CHAIR.

The Minutes of the Meeting of the 15th of November, 1905, were read and confirmed, and were signed by the President.

The List of Donations to the Society (exclusive of exchanges and reprints) received since the last Meeting, was read, and the thanks of the Society voted to the donors.

	From
Chamberlain, Chas. J. Methods in Plant Histology. 2nd edition. (Chicago, 1905)	*The Author.*
Coles, Alfred C. Clinical Diagnostic Bacteriology. (8vo, London, 1904)	*The Publishers.*
Farlow, Wm. G. Bibliographical Index of North American Fungi. Vol. i., part 1. (Washington, D.C., 1905)	*The Author.*
Kerr, Richard. Nature through Microscope and Camera. (8vo, London, 1905)	*The Publishers.*
Pantocsek, Josef. Beiträge zur Kenntniss der Fossilen Bacillarien Ungarns, III. Theile. (8vo, Pozsony, 1905)	*The Author.*
Slides mounted by Andrew Pritchard	*Mr. N. D. F. Pearce.*
Smith, Erwin F. Bacteria in Relation to Plant Diseases. Vol. i. (Washington, D.C., 1905)	*Carnegie Institution of Washington.*

The President called attention to a donation of slides prepared about fifty years ago by the late Mr. Andrew Pritchard. These had been presented to the Society by Mr. N. D. F. Pearce, and were exhibited under Microscopes in the room.

Mr. J. Rheinberg called attention to an exhibit consisting of a fine series of about twenty photographs of diatoms taken with the Zeiss apparatus for photomicrography with ultra-violet light. They had been given to him by the designer of the apparatus, Dr. August Köhler of Jena, and were of peculiar interest as being one of the first series of diatoms which Dr. Köhler had taken.

After referring to the arrangement for photomicrography with ultra-violet light,* and the great increase in resolving power consequent on being able to utilise light having a wave-length of 275 $\mu\mu$,† Mr. Rheinberg mentioned that he had heard that the first experimental photographs were taken about the year 1900 with objectives made from quartz and fluor-spar. Now the objectives and other lenses were made

* See this Journal, Aug. 1905, pp. 513–18.
† 1 $\mu\mu$ = one millionth of a millimetre.

wholly of one material, viz., fused quartz. That Dr. M. von Rohr should have been able to compute Microscope objectives free from spherical aberration from one material only was a remarkable achievement.

The photographs shown included a set of four of *Amphipleura pellucida*, taken under varying conditions with a 1·7 mm. monochromatic objective of N.A. 1·25, using light from the cadmium spark. The resolving power of this objective was therefore as great as that which an objective used with ordinary white light would have were it possible to give it a N.A. of 2·5. One of these photographs of *Amphipleura pellucida*, taken with oblique light from the condenser, showed the diatom clearly resolved into dots.

There were also five photographs of *Surirella gemma* taken with the same objective, and attention was called to the beautiful crispness and sharpness of the images, and also to the way in which the black and white dot effect came out.

Along with the photographs were comparison photographs of the same diatoms, giving the same magnification, viz., about 1800 diameters, taken with a 2 mm. apochromatic objective of N.A. 1·40, using light from a magnesium spark ($\lambda = 383\ \mu\mu$). The difference in the appearance of the images was very apparent.

Mr. Rheinberg remarked that the photographs showed that diatoms behaved in the ultra-violet light of the cadmium spark much as in ordinary light, but pointed out that many other substances transparent to ordinary light were more or less opaque to the light in question. For instance, it had been found that the fibres of the crystalline lens of the eye, certain cell membranes of plants, etc., were opaque to this light, and therefore yielded totally different images, which in some cases were clearer.

Taking this into account, besides the increased resolving power, he thought the new method of photomicrography was not only one of the most interesting, but also one of the most, if not *the* most notable advance in practical microscopy of modern times, and one, moreover, which might be very far-reaching in its consequences, as the first step having now been successfully accomplished as regards the use of monochromatic light of shorter wave-length than the ordinary, the future held the possibility of continuous gradual progress in this direction, accompanied by greater and greater resolving power.

The President thought that what Mr. Rheinberg had described was certainly a very important advance in photomicrography.

Mr. C. L. Curties said that the photograph of *Amphipleura* resolved into dots was one of the finest yet shown, but this was not the first time this diatom had been so resolved, for he remembered that a photograph showing the dotted structure was made by Mr. Gifford, and also that Dr. Spitta not only exhibited a photograph, but also the diatom itself in the adjoining room. They were, of course, not so distinctly resolved as the specimens now exhibited by Mr. Rheinberg.

Mr. Rheinberg said that he had not been aware that *A. pellucida* had already been resolved into dots. Whether new detail were seen, or whether merely an increased crispness were visible in the image, depended on the nature and degree of fineness of the structure being viewed.

Dr. Hebb read a letter from Mr. Pearce with reference to the slides by Andrew Pritchard, presented to the Society. A description of these slides, and also of an objective by James Smith, written by Mr. Parsons, was read to the Meeting.

Dr. Hebb also read the following letter from Mr. Nelson :—

"It may interest you to hear that the flagella of the tubercle bacillus can be seen with a dry lens. The apochromatic 4 mm. (long tube), by Zeiss, and the 7a (short tube), by Leitz, both will demonstrate the flagellum. There is nothing of particular interest in this of itself, but there is one point worth noting, which is that it is only the bacilli stained with fuchsin that will shine on a dark ground, other objects in the field such as nuclei stained blue, hardly show up at all upon a dark ground. Therefore, if the flagellum was, as has been said, some other object stained blue and lying fortuitously against the bacillus, it never would have been seen upon a dark ground. The image is necessarily a difficult one, even shining as it does with the fuchsin in it, but unless it was an integral portion of the bacillus and took the stain with it, it would be perfectly invisible."

A paper on "A Fern Fructification from the Lower Coal Measures of Shore, Lancashire," was read by Mr. D. M. S. Watson, and illustrated by lantern slides.

The President said it would be within the recollection of some of the Fellows present, that in his address in January, 1905, he attempted to deal with the question, "What were the Carboniferous Ferns?" and he then pointed out that many forms which were thought to be ferns were not so, but were seed-bearing plants of the class now known as pteridosperms. Things had gone on much further since then, and some persons might now answer the question, "What were the Carboniferous Ferns?" by saying that there were none! If he had known of Mr. Watson's specimens at the time of his address he should have brought them before the Society as examples of a true fern-fructification. Our knowledge had advanced in the meantime, and it was now known that *Crossotheca*, a synangic fructification, constituted the male organs of the pteridosperm, *Lyginodendron*, a discovery due to Mr. Kidston. He believed there were many of these fructifications which had been regarded as sporangia of ferns which were really the pollen-bearing organs of pteridosperms. He was inclined to refer Miss Benson's genus *Telangium* to *Crossotheca*, and to agree with her as to its belonging to some form of *Lyginodendron*. As regarded the example brought before them that evening, he did not think from the data that it was possible to express an opinion as to the group to which it really belonged. Its general resemblance to *Telangium* had rather struck him, but after all this might be only superficial. When he first saw Mr. Watson's sketches he thought the specimen was a *Ptychocarpus*, a fructification hitherto regarded as that of a Marattiaceous fern. The author, however, had shown sufficient reasons for placing his specimens in a new genus.

Professor F. W. Oliver remarked that the communication of Mr. Watson's paper to the Royal Microscopical Society was appropriate, as

the study of palæo-botany had made such immense strides since the Microscope had been drawn into its service. Turning to the subject of the paper, he said that much interest attaches to synangia of the Palæozoic age. Within the last few days Mr. R. Kidston had demonstrated with unerring certainty that the long sought pollen-bearing fructification of *Lyginodendron* was of this nature, whilst in the case of *Cycadeoidea* (*Bennettites*), another and more advanced branch of the Cycadian alliance, Dr. Wieland had shown some time ago that the male fructification was such as we now find in recent Marattiaceæ. Under these circumstances it seemed not inappropriate to consider whether any light was thrown on the morphological nature of the seed itself. Reference was made to the older view of C. A. Agardh, and also to that of Prantl, who compared the seed with a monangial sorus. An outline was given of Miss M. Benson's suggestion that the seed should be interpreted as a modified synangium or sporangial cluster, in which the peripheral sporangia had become sterilised to form the integument. That proposal at the time it was made did not gain universal acceptance, for one reason because of the difficulty encountered in proving that the synangium to which Miss Benson had given the name *Telangium* really belonged to *Lyginodendron*. Now, however, that we know for certain that representatives of two distinct groups of the earlier Cycadian forms possessed synangia as their male organs, the hypothesis undoubtedly gained in force. It was not likely to be lost sight of by fossil botanists.

Mr. E. A. Newell Arber said he would like to add his testimony to the great interest of this paper. He had hoped that this new synangium would throw some light on the great question of the day—"What were the Carboniferous Ferns?" He must confess, however, that the affinities of this new fructification seemed to be altogether doubtful. It was impossible to decide, in the present state of our knowledge, whether it was the male organ of a Pteridosperm, or the fructification of a true Fern.

He would like to ask Mr. Watson whether he had any information as to the mode of dehiscence of the sporangia, and especially as to the type of frond on which they were borne. He was struck by certain points of resemblance between the new synangium and *Ptychocarpus* and although the present fructification differed in certain important features from the synangia known under that name, he would rather expect to find that it was also borne upon a frond of the *Pecopteris* type.

If this was the case, it was somewhat remarkable that the fructification of such a frond should have been discovered from such a low horizon as the Lower Coal Measures, in which comparatively few members of the Pecopterideæ are known to occur. He suggested that an examination of further sections by Mr. Watson might afford some evidence as to the type of frond associated with these synangia, and thus perhaps confirm the distinct suspicion as to its nature suggested by a comparison between this new and interesting synangium and *Ptychocarpus*.

The President fancied Mr. Watson would tell them that the specimens had only recently been discovered, and everyone knew how long one must search before finding the connection between a fructification and the plant to which it belonged. He remained still rather sceptical as to Miss Benson's theory of the ovule, which Professor Oliver had brought

before them, though he agreed with her as to the attribution of her specimens.

Mr. Watson said that personally he thought it was most probably the fructification of a true Fern, probably a *Pecopteris*, but at present there was no evidence at all to show whence it came.

The President thought the Society had been fortunate in having not only so interesting a paper as Mr. Watson's, but also one which had brought out such valuable remarks from authorities on the subject.

Dr. Hebb gave notice, on behalf of the Council, that at the next Meeting a motion would be made for the purpose of suspending By-law No. 36, so as to enable Dr. Scott to be elected President of the Society for a third year.

Nominations for Council and Officers of the Society, to be submitted for election at the next Meeting, were then made, and Mr. J. M. Allen was appointed an Auditor on behalf of the Council.

Mr. C. L. Curties was then proposed by Mr. Marshall, seconded by Mr. Taverner, and unanimously elected Auditor on behalf of the Fellows of the Society.

Notice was given that the rooms of the Society would be closed from December 23 to January 1.

The following Objects, etc., were exhibited:—

The Society:—Slides mounted by Andrew Pritchard, 7 of Scales and Hairs, and 15 various objects mounted in balsam.

Mr. J. Rheinberg:—A series of 20 photographs of Diatoms taken by Dr. Köhler with the Zeiss apparatus for photomicrography with ultra-violet light.

Mr. D. M. S. Watson:—Transverse section of *Cyathotrachus altus* sp. n. from the Lower Coal Measures of Shore, and Lantern Slides in illustration of his paper.

ANNIVERSARY MEETING,

HELD ON THE 17TH OF JANUARY, 1906, AT 20 HANOVER SQUARE, W.
DR. D. H. SCOTT, F.R.S., ETC., PRESIDENT, IN THE CHAIR.

The Minutes of the Meeting of the 20th of December, 1905, were read and confirmed, and were signed by the President.

Pursuant to notice given at the preceding Meeting, Dr. Hebb moved the suspension of By-Law No. 36, for the purpose of enabling the Fellows to elect Dr. Scott as President of the Society for a third year.

Mr. J. J. Vezey having seconded the motion, it was put to the Meeting, and carried unanimously.

The President having appointed Mr. J. T. Pigg and Mr. Gardiner as Scrutineers, the ballot for Officers and Council was proceeded with.

The List of Donations, exclusive of exchanges and reprints, was read, and the thanks of the Society were voted to the donors.

	From
Frame containing Six Micro-Daguerreotypes taken with the Electric Light by Léon Foucault in 1844	*M. Alfred Nachet.*
Fifteen Slides of Oribatidæ	*Mr. N. D. F. Pearce.*

The President regarded the donation from M. Nachet as exceedingly interesting. Personally, he was greatly surprised to hear that the electric light had been used in photomicrography so far back as 1844. M. Nachet had been a Fellow of the Society for over a quarter of a century, and he thought their special thanks were due to him for sending them this valuable present.

The following letter from M. Nachet accompanied the donation :—

17 RUE ST. SÉVERIN, PARIS.
14 *Janvier*, 1906.

MONSIEUR LE PRÉSIDENT,

J'ai le plaisir de pouvoir offrir à la R.M.S. quelques photographies microscopiques qui sont probablement des plus anciennes que l'on puisse trouver.

Ces photographies sont executées sur plaques d'argent d'après la méthode publiée par Daguerre en 1839.

Moins de trois ans après, notre grand physicien, Léon Foucault, alors jeune étudiant en médecine, imagina avec son maître, le Dr Donné de la Faculté de Paris, d'appliquer la photographie microscopique à la reproduction des préparations anatomiques et des éléments des liquides sanguins et autres.

Après deux ans de travail, ces photographies furent reproduites par la gravure dans le bel atlas de microscopie qu'ils publièrent en 1841.

C'est avec un microscope analogue à l'ancien microscope solaire que Foucault commença ces belles photographies, mais fatigué des variations constantes de la lumière solaire, il imagina d'appliquer la lumière électrique, et créa alors, la première lampe à point lumineux fixe et le microscope photo-électrique à condensateur, décrit dans la préface de l'atlas, par son maître et collaborateur le Dr. Donné.

Ces photographies sont donc contemporaines de Daguerre et de la première application de la lumière électrique aux études scientifiques.

Ces plaques originales qui sont venues en ma possession, peuvent soutenir la comparaison avec les reproductions microscopiques faites actuellement ; elles sont presque toutes datées et signées de la main de Léon Foucault.

C'est une vraie satisfaction pour moi, M. le Président, de pouvoir enrichir la collection de la Société Microscopique par la présence de ces témoins des efforts faits par les anciens micrographes.

Veuillez croire, M. le Président, à mes sentiments les plus respectueux.

ALFRED NACHET, F.R.M.S.

Some excellent micro-photographs of Diatoms and Podura scales were sent for exhibition by Mr. T. A. O'Donohoe, who states they were all taken with a Swift Portable Stand, Zeiss Apochromatic Objective 2 mm. N.A. 1·30, Oil Lamp, and a very cheap enlarging Camera.

Mr. O'Donohoe also sent some remarks made by Mr. Nelson upon these photographs, from which the following extracts have been made :—

The *Amphipleura pellucida* is an excellent photograph of the so-called striæ; the black lines are nice and thin.

The *Surirella gemma*.—The black dot picture is excellent.

The Podura scale is excellent, especially in the upper part to the left hand. The structure upon the membrane is shown. This proves that the focus was right.

Pleurosigma angulatum.—The × 2000 photograph is a long way the best. There is a part where the silex is admirably rendered with round holes in it and slightly darker edges. I think this is as good a representation of *angulatum* as any I have ever seen. You will notice that this is really a black dot picture, for if the hole had been smaller the dark fringe of the edge of the hole would have met and made a black dot.

The size of the fringe depends upon the working aperture, that is, upon the size of the disk of light illuminated at the back of the objective.

The white dot images at the top and bottom of the photograph are ghosts, the focus being too long. The bit near the nodule is good, but not so good as the part indicated above, because it exhibits a tendency to run into lines.

The Report of the Council for the year 1905 was read by the Secretary, as follows:—

REPORT OF THE COUNCIL FOR 1905.

FELLOWS.

Ordinary.—During the year 1905, 19 new Fellows have been elected and 1 re-instated, whilst 6 have died and 14 have resigned.

Honorary.—The following were elected Honorary Fellows at the Meeting in March last: Professor William Gilson Farlow, Professor Herbert S. Jennings, Professor Edmund B. Wilson, and Professor R. W. Wood, all of the United States.

The Council regrets to have to announce the deaths of Professor Abbe (of whom an obituary notice by Mr. J. Rheinberg appeared in the Journal for April), Dr. P. T. Cleve, and Professor A. von Kölliker.

The number of Honorary Fellows is now 42.

The list of Fellows now contains the names of 414 Ordinary, 1 Corresponding, 42 Honorary, and 82 Ex-Officio Fellows, being a total of 539.

FINANCE.

The Treasurer regrets to report that the amount received for Subscriptions during the year is nearly £45 below that for 1904. As the number of Fellows has not decreased, the diminution is chiefly due to the fact that many more are in arrears than formerly, indeed there is over £100 overdue.

This is much to be regretted, for it not only makes it more difficult to arrange the finances of the Society, but it seems to show that the habit of unpunctual payment on the part of some Fellows is growing, in addition to which the amount of clerical work is greatly increased by this laxity in payment, as at least three notices have been sent to every Fellow in arrears. The Council would be sorry if it should become necessary to follow the custom of other Societies in this matter and publish the names of those who have not paid their Subscription; but it is certain that something of the sort must be done unless the evil is corrected.

JOURNAL.

The Journal, somewhat larger than in recent years, contains several papers, two of which, on Metallography, indicate the advances made in the application of the Microscope to the industrial arts. All the papers attain the standard of previous years. Ten less lengthy, but perhaps not less important and useful communications are included in the "Notes."

The Summary of Current Researches relating to Zoology, Botany, Microscopy, and Metallography is continued on the same lines as heretofore.

The thanks of the Council are due to the Editorial Staff, among them being two ladies distinguished in Botany, for their unremitting attention and excellent contributions.

LIBRARY.

The Library is in better order than at the corresponding period of last year, mainly owing to a grant for binding given by the Council—though in this direction a good deal remains to be done. It has been found impossible to afford the luxury of a printed catalogue.

INSTRUMENTS AND APPARATUS.

The Instruments and Apparatus in the Society's Collection continue to be in good condition.

During the past year the following additions have been made:—

Jan. 18.—An Adams' Lucernal Microscope by W. and S. Jones; an Old Portable Microscope. Both presented by Lieut.-Col. Tupman.

April 19.—An Old Portable Microscope by W. and S. Jones. Presented by Mr. W. S. Rogers.

May 17.—An Old Microscope by Nathaniel Adams. Presented by Mr. J. E. Haselwood.

June 21.—A Pocket Botanical and Universal Microscope by W. and S. Jones; a Wilson Screw-barrel Microscope; an Old Portable Microscope by Shuttleworth. All three presented by Mr. C. Lees Curties.

Oct. 18.—An Old Wilson Screw-barrel Microscope. Presented by Major Meade J. C. Dennis.

Nov. 15.—A Lucernal and Solar Microscope by Adams. Presented by Mr. Wynne E. Baxter.

CABINET.

During the past year 24 mounted slides of Seeds of Orchids, Diatoms, etc., were presented by Mr. W. M. Bale, a Fellow of the Society, and 22 Slides made by the late Andrew Pritchard, were kindly presented to the Society's Cabinet by Mr. N. D. F. Pearce, of Grantchester. Twelve of these slides are early specimens of mounting in balsam, the objects being inserted between slips of ordinary glass about 1¾ by 1 inch.

The Treasurer also read his statement of accounts, and the duly audited Balance Sheet for the same period.

Mr. Disney moved, "That the Report and Balance Sheet now read be received and adopted." He regretted to hear the Treasurer's remarks as to the number of subscriptions in arrear, but hoped that the progress of affairs during the coming year would be such as would put the Treasurer in a more cheerful frame of mind at the next Annual Meeting.

The adoption of the Report and Balance Sheet having been seconded by Mr. Radley, the motion was put to the Meeting by the President, and carried unanimously.

Dr. CASH STATEMENT FOR THE YEAR ENDING 31st DEC. 1905. Cr.

1905.	£	s.	d.	£	s.	d.
To Balance from 1904				68	1	1
„ Admission Fees				39	18	0
„ Compounding Fee				23	12	6
„ Annual Subscriptions—						
1903	8	8	0			
1904	34	2	6			
1905	559	7	8			
1906	15	15	6			
				617	13	8
„ Interest on Investments, etc.				59	14	9
„ Legacy (E. Dadswell)				50	0	0
„ Sale of Journal				276	13	4
„ Receipts for Advertisements				60	0	0
„ „ „ Sale of Surplus Books				5	5	0
„ „ „ Reprints, Catalogues, and List of Fellows				4	14	6
„ Withdrawn from Deposit				200	0	0
„ Income Tax returned				2	17	11
				£1408	10	9

1905.	£	s.	d.	£	s.	d.
By Rent, Coals, etc.				133	2	6
„ Salaries and Reporting				181	19	0
„ Books purchased				99	8	0
„ Bookbinding				11	8	9
„ Expenses of Journal—						
Editing	£157	6	6			
Illustrations	33	10	8			
Printing and Postage	405	8	9			
				596	5	11
„ Purchase of 38*l.* 16*s.* India Three per Cents.				37	9	5
„ Placed on Deposit at Bank				200	0	0
„ Refreshments at Meetings				13	10	0
„ Stationery				15	12	8
„ Fire Insurance				3	5	0
„ Postage and Petty Expenses				37	5	9
„ Rent on Stock of Journal (two years)				6	6	0
„ Balance to 1906				72	17	9
				£1408	10	9

Investments.

	£	s.	d.
North British Railway	400	0	0
Nottingham Corporation Stock Three per Cents.	400	0	0
New South Wales Three and Half per Cents.	315	11	1
India Three per Cents.	863	19	7
	£1979	10	8

J. J. Vezey, *Treasurer.*

We have examined the foregoing Account, and compared the same with the Vouchers in the possession of the Society; we have also verified its Securities as above mentioned, and find the same to be correct.

J. Mason Allen
C. Lees Curties } *Auditors.*

The Scrutineers having handed in the result of the Ballot, the following Fellows were declared to have been duly elected as Officers and Council of the Society for the ensuing year :—

President—Dukinfield Henry Scott, M.A. Ph.D. F.R.S. F.L.S.

Vice-Presidents—Wynne E. Baxter, J.P. F.G.S. F.R.G.S.; A. N. Disney, M.A. B.Sc.; George C. Karop, M.R.C.S.; The Right Hon. Sir Ford North, P.C., F.R.S.

Treasurer—J. J. Vezey.

Secretaries—Rev. W. H. Dallinger, LL.D. D.Sc. D.C.L. F.R.S. F.L.S. F.Z.S.; R. G. Hebb, M.A. M.D. F.R.C.P.

Ordinary Members of Council—Jas. Mason Allen; Conrad Beck; Rev. Edmund Carr, M.A. F.R.Met.S.; J. W. H. Eyre, M.D. F.R.S. (Edin.); A. D. Michael, F.L.S.; Henry George Plimmer, F.L.S.; Thomas H. Powell; C. Price Jones, M.B. (Lond.); P. E. Radley; Julius Rheinberg; Charles F. Rousselet; Henry Woodward, LL.D. F.R.S. F.G.S. F.Z.S.

Librarian—Percy E. Radley.

Curator—Charles F. Rousselet.

Dr. Scott said he should like to thank the Fellows of the Society for the honour they had conferred upon him by electing him as their President for a third year, an honour which he quite realised was a special one, and one to which he had no claim; indeed, it never entered his head that he would be so elected until the proposal was mentioned to him a short time ago. But although he felt particularly pleased and honoured by this act of theirs, he felt it the more because he was very conscious of his own deficiencies. One thing which always struck him very strongly was the extreme importance of the work which the Society did on the Physical and Optical side. It was perhaps upon this side that the centre of gravity of the Society lay, and it was here especially that he felt himself deficient. He was much gratified, however, that, as a purely Biological President, he had been able to give them satisfaction.

Mr. A. D. Michael having taken the Chair, the President delivered his Annual Address—taking for his subject "The Life and Work of Bernard Renault," illustrating the subject with Lantern Slides, including photographs of Renault and his laboratory, as well as some examples of his work in Palæo-botany.

Mr. Michael said they had heard with great interest the account of the work of the somewhat ill-requited French investigator of Fossil Botany, and he was quite sure that nobody could have been more competent to deal with such a subject than their President. It would not only be a valuable record of Renault's work, but it would embellish their Journal and be a record of value in times to come. He had great pleasure in moving a hearty vote of thanks to the President for his Address, and in asking him to allow it to be printed and circulated in the usual way.

Mr. J. J. Vezey had much pleasure in seconding this vote of thanks for the Address, which had been very interesting, but which Fellows would no doubt be able more fully to appreciate when they saw it printed in full in the Journal. He should like also to couple with this motion

a vote of thanks to Dr. Scott for his consent to remain the President of the Society for another year. The subjects he had brought before the Society in the past year had been of great interest and to many of the Fellows quite new. The President had referred to his own want of knowledge of the "brass and glass" side of the Microscope, but it must be remembered that questions relating to the optical construction of the Microscope, however interesting and important, would be of little value were it not for the practical application of the instrument to the purposes of scientific research and demonstration.

As the President could not very well put this to the Meeting himself, it was submitted by Mr. Vezey, and unanimously carried.

The President said he was greatly obliged to Mr. Michael and to Mr. Vezey for the extremely kind words in which they had moved and seconded this vote of thanks, and to all present for the kind way in which they had received the address. He had felt some pleasure in bringing this subject before them, not only on account of the interest he took in the kind of work done, but because he was glad to be able to do something to honour the memory of a worker whose contributions to the subject of fossil botany had been so considerable, and whose work had been so little appreciated in his lifetime. He believed, however, that it was contemplated to do him some posthumous honour by naming a street in Paris after him, and that a number of letters had been written by members of the French Academy supporting this idea.

A vote of thanks to the Honorary Officers of the Society for their services during the past year was moved by Mr. Maurice Blood, seconded by Mr. A. S. Hoole, and unanimously carried.

The President said he had depended entirely upon the Officers of the Society for the conduct of its affairs, and he had never known a society to run so smoothly as this. Personally he was called upon to do very little, so that the successful working of all their business was entirely due to the Officers.

Mr. J. J. Vezey, in responding to this vote on behalf of the Hon. Officers, said they were very much obliged for this expression of approval, and it was a great pleasure to hear what the President had just said as to the smoothness with which the work of the Society had been carried on by the help of the Officers.

Votes of thanks to the Auditors and Scrutineers were then moved by Mr. Frank Orfeur, seconded by Mr. Taverner, and on being put to the Meeting by the President, were carried unanimously.

New Fellows.—The following were elected *Ordinary* Fellows: Messrs. P. Murrell and Frederic J. W. Plaskitt.

The following Objects were exhibited:—

The Society:—A frame containing six micro-daguerreotypes of blood milk, etc., taken with the electric light by Léon Foucault in 1844.

The President:—A number of Lantern Slides, including photographs of Renault and his laboratory, in illustration of his Address.

B. Renault

JOURNAL

OF THE

ROYAL MICROSCOPICAL SOCIETY.

APRIL, 1906.

TRANSACTIONS OF THE SOCIETY.

II.—*The President's Address: Life and Work of Bernard Renault.*

BY DUKINFIELD H. SCOTT, F.R.S.

(*Read January* 17, 1906.)

PLATES IV. AND V.

I have chosen this subject for my address this year for two reasons. First, because Bernard Renault did more than any other man—with the possible exception of my late friend Professor W. C. Williamson, for whom we may perhaps claim an equal place—to make known the structure of fossil plants by microscopic investigation; and secondly because he was an Honorary Member of our own Society. It is a source of great satisfaction to me that we were able to do him this honour, conferred within six months of his death, for in his own country his merits, though realised by his scientific colleagues, by no means received the public recognition they deserved. On several occasions the subject of the structure and relationships of extinct plants has been brought before you, by others as well as by myself, and it is not, I trust, inappropriate that we should give our thoughts this evening to the career of one who, in his own field of research, acted so consistently in the spirit of our motto: "Minimis partibus, per totum Naturæ campum, certitudo omnis innititur."

Bernard Renault was born at Autun on March 4, 1836, of respectable middle-class parentage. After a creditable career as schoolboy and student, he became Bachelor of Science at the Autun College in 1854, and Bachelor of Letters the next year. He then

entered the Institut Brenot at Dijon, where he was soon afterwards appointed Professor of Chemistry and Physics. For some time he was known to the scientific world as a chemist, and his publications for the first few years of his career were all on chemical subjects. An important Thesis on Electrolysis obtained for him in 1867 the degree of Doctor of Physical Science at Paris, and a post at the Normal School of Cluny.

But in the mean time Renault had begun the work to which his mature life was to be devoted. The neighbourhood of his native place, Autun, was formerly extraordinarily rich in silicified remains of plants, which in certain fields lay on or near the surface of the ground, so as to be turned up by the plough in such quantities as to be compared to the débris of a forest. Seventy years ago these precious fragments were even used for mending roads. It seem that when Renault began to interest himself in these specimens they had already become comparatively scarce, but enough re mained to repay industrious search, and besides, there were impor tant collections previously made, notably those of M. Faivre an the Abbé Landriot. It appears to have been the former, an arden local collector, who introduced Renault to the laborious work o preparing the fossil specimens for examination. Throughout hi life Renault was in the habit of making his own preparations—a extraordinarily slow and difficult task, especially when the petrify ing material is hard silica, as is the case with these Frenc specimens. Unfortunately, he had little or no assistance, and hi work, in spite of his incomparable industry, was restricted by th mechanical difficulty.

Renault made a practice of communicating his discoveries an preparations to Adolphe Brongniart, the great founder of scientif Palæobotany, who at that time was Chief Inspector of Mines at Pari It was sometimes part of the great savant's official duty to inspe the Normal School at Cluny, where Renault was then in charge the chemical teaching, and was thus only able to give his leisu moments to Fossil Botany. Brongniart is said to have found son consolation in these meetings with his enthusiastic disciple f the dulness of an official visitation.

The late M. Roche, the friend and collaborator of Renault, wl unhappily has not long survived his distinguished colleague, and whose biography of his friend I am deeply indebted, gives a viv account of fossil-collecting in the stony fields of the Autun countı During the holidays, Renault was to be found almost every d "beating the fields for specimens, an exercise in which he fou rest from his indoor work. With his geologist's satchel on l back, and his big hammer in his belt, he knew how to lead us his train; he always returned with loads beyond our streng Next day we witnessed his delight, when, after a thorough washi of the blocks, he found some parts preserved. The bad piec

which he did not want, were remorselessly thrown into the gutter." (Roche, 1905, p. 17.)

One day, when Renault was accompanied by his friend Grand'Eury, another illustrious palæobotanist, who happily is still with us in full vigour, a curious incident occurred. Grand'Eury, as they approached a good locality, asked his friend, "What do you want me to find?" "A *Sigillaria* with its bark on," replied Renault. In a minute or two Grand'Eury picked up a block, and without examining it said, "There's the *Sigillaria* you asked for." Chance had favoured him. Renault cleaned the specimen according to custom; it revealed itself as a magnificent *Sigillaria spinulosa*, which formed the subject of one of his best known memoirs, written in collaboration with Grand'Eury. (Renault, 1874.) It was ten years before another piece was found, and no more has been met with since then. Those who have worked at such subjects may be able to recall coincidences almost as surprising.

It was from the permocarboniferous deposits, both at Autun and at Grand Croix near St. Etienne, that Renault drew most of the material for his detailed studies. But he was able to add to the resources of palæobotanical science by the discovery of a fossiliferous bed at a much lower horizon. At Esnost, twelve kilometres from Autun, there had been some prospecting for coal as long ago as 1812. Renault examined the débris from the abandoned pits, and was able to show that they contained fossils of Lower Carboniferous age, of the stage unfortunately called Culm on the Continent, though the original Culm of Devonshire, from which the name is taken, is now known to have been of much later date, as Mr. Arber has shown. In the Lower Carboniferous of Esnost, Renault made important discoveries of petrified plants, including specimens of *Archæocalamites*, the most ancient type of Equisetales, *Lepidodendron* and its cones, with other Lycopodiaceous remains, the fern-like *Diplolabis* with its fructifications, and other fructifications of the groups, now so problematic, allied to Ferns.

Renault had scarcely started on his palæobotanical career, when he was called away on duty of a very different and sterner character. One of his earliest and most important discoveries, that of the anatomical structure of the remarkable genus *Sphenophyllum*, was communicated to the French Academy on May 30, 1870. As no one of my generation is likely to forget, war was declared by France against Prussia on July 15 of that year. During the succeeding siege of Paris, the illustrations to the *Sphenophyllum* memoir were lost, and its publication long delayed (till 1873). Renault himself, however, had no leisure for scientific regrets. "When the terrible year arrived," says M. Roche, "Renault, esteemed by all, and well known for his honourable

character, was designated by the Committee of National Defence, sitting at Lyons, to organise the defence at various points of the Saône-et-Loire. This mission was full of difficulties, in the midst of the orders and counter-orders coming from every quarter, and representing the unhappy disorder resulting from an improvised defence. Though constantly called from one point to another, searching for cartridges which were abundant just where they were not wanted, he succeeded in giving satisfaction to administrators overwhelmed by the critical position; he received the greatest eulogies." Though Renault does not appear to have been exposed to the dangers of actual war, he none the less had to suffer severely for his country. On his way to Autun, then threatened by the Prussians, he was seized with smallpox, so prevalent under the evil conditions of war-time, and for some days was given up by the doctors. His friend, M. Penjon, Professor of Philosophy at Lille, came to his assistance during his illness; Renault did not forget his timely aid, and commemorated him in the name of the now famous fossil fructification, *Cordaianthus Penjoni* (Roche, 1905 p. 7). During his convalescence, Renault once more found recreation in collecting and preparing the fossil plants of his native district.

With the return of more peaceful times an important chang took place in Renault's position. In 1872 he was summoned b Brongniart to the Museum of Natural History at Paris—the fiel of all his future labours. He co-operated with his great chief i the classical work on silicified seeds, published posthumously unde Brongniart's name in 1881 (Brongniart, 1881).

For the first four years Renault had no other title than that "Préparateur," but in January 1876 he was officially nominate "Assistant Naturalist at the Museum, attached to the Chair Botany, Organography, and Physiology." This modest post wa all he obtained to the day of his death. Few men so distinguishe have received such miserably inadequate recognition from the official chiefs, an injustice which his learned countrymen cann speak of without indignation.

Renault had no laboratory at first; after a time, however, induced the architect of the museum to put up for him, under t head of "repairs," two little glazed wooden boxes, one on ea side of the portico of the botanical and geological departme Chevreul, the venerable director of the museum, was indigna when he first saw this inartistic excrescence on the architecture his building. The little boxes are shown in the accompanyi photograph, taken by my friend, Professor F. W. Oliver, last Apr The one to the left was the workshop where Renault cut his fos sections, that to the right was the laboratory proper, where microscopic work went on, and where he received his scienti visitors. "Renault's cage," as the laboratory was jocosely call

Renault's Workshop and Laboratory, in the portico of the Musée d'Histoire Naturelle.

[To face p. 132.

constituted to the end of his life his only official quarters. It looks exactly like a porter's lodge, and the savant whom it sheltered was often addressed by strangers as the concierge, a comic situation which he thoroughly enjoyed. Visitors to the laboratory, as I know to my cost, were sometimes the victims of the same mistake, and were not always equally capable of dealing with the position.

In this tiny laboratory the material result of Renault's labours is now deposited, in the form of no less than 7000 preparations showing the structure of fossil plants, almost all of them, as I understand, the work of his own hands. He utilised, of course, at the same time the great collections of the museum. "The fossil impressions," as M. Roche says, "were his herbarium, the silicified wood his anatomical material."

The eminent physiologist, Paul Bert, interested himself in Renault's work, and it was through his efforts that the latter was authorised to give a course on Vegetable Palæontology, undoubtedly the most important course of lectures ever given on this subject. It extended over five years, from 1879–83, and was almost wholly based on his own researches. After every lecture there was a demonstration of the actual specimens and preparations, and each hearer received a copy of the illustrations prepared for the course. The lectures of the first four years were published at Renault's own expense, and form his famous "Cours de Botanique Fossile," a classical work, which will always be indispensable to the student of fossil plants. The groups dealt with are exclusively the fossil Vascular Cryptogams and Gymnosperms. Then, as now, there was much difficulty and dispute as to the true boundary between these two divisions, though the position of the contested frontier has somewhat shifted since those days. The limits of the "Cours" are still those within which the real triumphs of fossil botany have been won. A smaller and more popular manual was published in 1888, "Les Plantes Fossiles." It was a great misfortune that the course was never resumed. Paul Bert wished to have a Chair of Vegetable Palæontology founded for Renault, which was obviously the right thing to do; but this, and all other efforts on his behalf, were unhappily frustrated. Simultaneously with the commencement of this course, in 1879, Renault brought out his important work, "Sur la Structure Comparée de quelques Tiges de la Flore Carbonifère." Besides other investigations of much value, this memoir contains his wonderful account of the complete structure of the fossil Gymnospermous family, Cordaiteæ, in all their organs reproductive as well as vegetative, perhaps the most remarkable redintegration of a wholly extinct group of plants which has yet been accomplished. The "Tiges Comparées" was his main thesis for the degree of Doctor of Natural Science.

Renault's work went on amid depressing conditions of neglect and even hostility. I am neither able nor willing to dwell on the

nature of these discouragements, but it is right that they should be referred to in order that we may do justice to the indomitable pluck and perseverance which enabled him to work on, in spite of all depressing influences, with undiminished energy and zeal. It is, however, deeply to be regretted that owing to the want of proper assistance his work was seriously hampered, and much valuable material remained unutilised at the time of his death.

Apart from the scientific papers—200 or more in number—to some of which I shall refer in the second part of this address, we may mention the great "Étude sur le Terrain houiller de Commentry," published in 1888–90, in which M. Zeiller co-operated, a complete account of a rich flora of Upper Coal-Measure age. A work of even greater importance from a general point of view was the "Bassin houiller et permien d'Autun et d'Épinac: Flore Fossile." The first volume, limited to Ferns, was by M. Zeiller, and appeared in 1890. The second, accompanied by a magnificent atlas of over 60 plates, is the sole work of Renault; it appeared in 1893–6, and deals with all groups of palæozoic plants, and more especially with their internal structure. In this great book his work may be said to have culminated, though the stream of his publications flowed vigorously to the last.

Renault appears to have been as successful in the character of a public lecturer, especially at his native town of Autun, as he was in the field of original investigation. M. Roche speaks of him as "a great populariser of Science." Owing chiefly to his influence Autun became a scientific centre of an importance almost unparalleled in the case of a provincial town.

Renault's health began to be seriously affected in the year 1902 when he was much troubled by retinal hemorrhage, which for some time compelled him to forego the use of Microscope or lens—a painful deprivation to so zealous an investigator. This affection of the eyes was but a symptom of severe internal mischief, and the end soon approached. It is a comfort to learn that the patient suffered little and never realised his danger, his friends, who were well aware of his critical condition, studiously keeping the knowledge from him. He preserved his consciousness to the last, without any anticipation of death, and passed away on October 1[illegible] 1904.

The French Academy had always recognised the value of Renault's work, as shown by various prizes awarded him, at dates ranging from 1873 to 1902. Since his death I hear that it has been proposed to name one of the streets of Paris after him, a honour often conferred on deceased men of science in that capital. I have had the privilege of seeing a large number of letters from Members of the Academy vigorously supporting this proposal.

For the photograph of Renault reproduced in this address I am indebted to his cousin, Madame Bocquet Renault, who, I unde

stand, was accustomed to help him in his work as secretary. The photograph was taken in 1888, when he was 52 and in full vigour. The only time I met Renault myself was five years later; he then already looked appreciably older. On that visit I found him just emerging from his workshop, where he was evidently in the act of preparing some of his fossil sections. He was exceedingly kind in showing me the most interesting things in his collection, and I remember he at once convinced me of the truth of one of his conclusions, as to which we in England had been somewhat sceptical up to that time, namely that the fossil named *Astromyelon* by Williamson was really the root of *Calamites* (Renault, 1885 and 1896). The generous and candid treatment which I experienced on that occasion at Renault's hands was the more admirable, as he evidently regarded me as an emissary from the enemy's camp, for I was then working in conjunction, as a junior colleague, with Williamson, his old rival and often his opponent. The position might have been difficult, but Renault happily possessed a sense of humour, and any divergence there may have been on scientific questions only added a certain piquancy to our personal relations.

Renault's work as a palæobotanist was far too extensive to be dealt with as a whole within the limits of a Presidential address. The most that can be attempted is to give a few illustrative examples.

As M. Zeiller points out, the work of Renault falls naturally into two divisions (Zeiller, 1904); the first embracing his investigations of the higher fossil plants, more especially the structural specimens from Palæozoic strata, while the second was concerned with fossil micro-organisms, Bacteria, Fungi, and the lower Algæ, and their action, especially in relation to the production of coal in its various forms.

The second period coincides approximately with the last ten years of his life; but the two lines of work overlapped, his researches on the higher plants continuing to the last, concurrently with the investigation of micro-organisms.

I shall here limit my remarks almost wholly to the former, which is more familiar to me, and is also, without question, of more assured value.

1. Botryopterideæ.

Renault's first palæobotanical paper (dated 1868, but published in 1869) is on a Fern-like petiole (*Anachoropteris pulchra*), from the Upper Coal-Measures of Autun (Renault 1868). He noted, among other points, the presence of pitted elements in the wood—a rare character among true Ferns. Though of no great importance in itself, this early work stands in close relation to one of his most fertile lines of research.

A little later, in a memoir dated 1869, but not published till after the war, in 1871 (Renault, 1869), the structure of stem and petiole is described, and their relations determined, in the two genera *Zygopteris* and *Anachoropteris* (*Z. Brongniartii* and *A. Decaisnei*). The genera are well distinguished by their petiolar structure, though the stem with its single vascular cylinder, recalling that of some of the Filmy Ferns, is of similar organisation in both. At the same time the petioles of other species of *Zygopteris* were described. This was an excellent piece of work, and we shall see to what it led.

A few years afterwards, in 1875, Renault announced the discovery of a new genus, *Botryopteris* (Renault, 1875), giving an accurate account of the anatomy of the stem, although he had only a single fragment to work with. This is, perhaps, the simplest type of stem known, the vascular cylinder consisting merely of a solid strand of tracheides, and affords the rare case of a Palæozoic plant differing in the direction of greater simplicity of structure from its probable nearest allies in the recent flora. This, however, even in the case of *Botryopteris*, only applies to the stem. Renault further described the characteristic petiole, and, what was more important, was able to identify the fructifications, dense masses of large, pyriform sporangia, each with a broad, band-shaped "annulus." He found that they were grouped in tufts on the branches of a naked rachis, indicating dimorphism of the fertile and sterile fronds. As regards the affinities of the new genus, Renault pointed out, with remarkable acumen, analogies with the Hymenophyllaceæ, Osmundaceæ, and Ophioglossaceæ, inferring that there was a relation to all three groups, and coming to the conclusion that *Botryopteris* was intermediate between the true Ferns and the Ophioglossaceæ. His views appear fully justified in the light of later research.

The next year (Renault, 1876) the fructifications of *Zygopteris* were discovered, and proved to present a clear affinity with those of *Botryopteris*, though differing in well-marked generic characters.

In the Cours de Botanique Fossile (Renault, 1883), the two genera are treated as the representatives of a distinct family, the Botryopterideæ, which from that time onwards has played a more and more important part in the taxonomy of the Palæozoic flora (Renault, 1891 and 1896). Although some of Renault's conclusions, especially as to the heterospory of the family, may not have been substantiated, one of his greatest services to science was the recognition of this group—far more extensive, probably, even than he imagined. At the present time they are regarded by many authorities as the most important representatives of the primitive Filicineæ, which long preceded the advent of Ferns, in the narrower sense, as we know them at the present day.

2. Pecopterideæ.

At the present moment much of the interest of Palæozoic botany centres in the Pecopterideæ. The discoveries of the last three years have transferred so many of the so-called Ferns to the ranks of seed-bearing plants, that doubts have even been expressed whether, at least in the older Carboniferous strata, there were any true Ferns at all. Apart from the Botryopterideæ, a group which some would separate from the Ferns proper, the last refuge of the true Ferns has hitherto been found in the genus *Pecopteris*. This stronghold, it is true, was rudely shaken when, in April of last year, M. Grand'Eury discovered fronds of *Pecopteris Pluckeneti* laden with seeds! The species, however, is an aberrant one, and cannot decide the fate of the genus as a whole. A large number of the species of the form-genus *Pecopteris* are known to have borne fructifications of the type commonly recognised as Marattiaceous. The sporangia are somewhat massive, without a definite annulus, and, in the more characteristic cases, are united together, like the carpels of a multilocular ovary, to form compound fructifications known as synangia. While our knowledge of the external characters of such fructifications is chiefly due to Stur, Zeiller and Grand'Eury, it is to Renault, more than anyone else, that we owe an acquaintance with their internal organisation, which he described in *Scolecopteris polymorpha*, *Ptychocarpus unitus*, *Pecopteris geriensis*, *P. oreopteridia*, *P. exigua*, *Sturiella intermedia*, and others (Renault, 1883 and 1896). The case last mentioned is particularly interesting, as here the sporangia, though grouped in definite synangia, possess a kind of annulus, thus showing a remarkable combination of characters. Renault's observations undoubtedly tended strongly to confirm the idea of the Marattiaceous affinities of the fossils in question. Whether this view, once, as it seemed, so unassailable, can hold its ground, or whether we shall have to admit that all these fructifications, like *Crossotheca Höninghausi*, were but the pollen-bearing organs of Pteridosperms, cannot yet be decided. In either event, the ultimate decision will rest, in no small degree, on the accurate data afforded by Renault's researches.

3. Neuropterideæ.

The building-up of our knowledge of this family, now recognised as one of the main divisions of the Pteridosperms, has been the work of many investigators, among whom Renault claims an important place. It was he who first demonstrated the anatomical structure of the leaves of *Neuropteris* and *Alethopteris*, and was able to show that their petioles were identical with the petrified specimens long previously named *Myeloxylon* by

Brongniart. The evidence for this conclusion is fully stated in the "Cours de Botanique Fossile" (Renault, 1883), where it is shown that the type of petiole previously known as *Myeloxylon Landriotii*, was characteristic of *Alethopteris*, while the structure of *M. radiatum* belonged to species of *Neuropteris*, and perhaps also of *Odontopteris*, results which confirmed the acute suggestions already made by M. Grand'Eury.

Some years previously Renault had prepared the way by a detailed study of the structure of the petioles in question (Renault, 1874) which he then re-named *Myelopteris*. The reason for this change in nomenclature was his conviction that these organs belonged to Marattiaceous Ferns, an opinion which he still maintained in 1883, though by that time evidence had already been brought forward in Germany to show that *Myeloxylon* was the petiole of *Medullosa*, a genus of stems then regarded as Cycadean. We now know that the Neuropterideæ or Medulloseæ were seed-bearing plants, approaching the Cycads, but retaining characters indicative of affinity with Ferns in a wide sense. Renault's idea of Marattiaceous relationship, in fact, is still tenable, for the latest view, expressed by a high authority, is that the Pteridosperms (including Neuropterideæ) had a common origin with the Marattiaceæ. Almost at the close of his life, Renault recognised the new position which the question had assumed, for in his last published work, presented to the Academy on May 15, 1904, in maintaining the multiple origin of Phanerogams from different Cryptogamic phyla, he cites the Medulloseæ, and especially *Colpoxylon aeduens* (Renault, 1896), the structure of which he had himself revealed, as probably connecting the Ferns with the Cycads (Renault, 1904).

The plants which Renault, by his anatomical researches, s[o] largely contributed to reconstruct, constituted a most remarkabl[e] group. The often massive stems, with a complexity of structur[e] scarcely to be paralleled among recent plants, bore enormou[s] petioles, often 6 inches in diameter, branching out into great com[-] pound leaves suggesting some huge *Angiopteris* or *Osmunda*; o[n] the fertile pinnæ of these fern-like leaves were borne the seed[s] resembling those of Cycads, and sometimes, as it appears, of a[n] immense size. The strange and unfamiliar appearance present[ed] by a female *Cycas* in fruit, can give us but a faint idea of th[e] bizarre habit of the extinct family.

4. Cordaiteæ and Poroxyleæ.

The wonderful reconstruction of the Cordaiteæ by Renault a[nd] Grand'Eury, the former working from anatomical characters, t[he] latter from external features, has already been referred to, and [is] familiar to all students of Fossil Botany. It was their work whi[ch]

for the first time, gave us a clear conception of Palæozoic Gymnosperms. While Grand'Eury, with his admirable restorations, revealed the habit of these great trees, now only distantly recalled by that of some Southern Conifers allied to the Kauri Pine of New Zealand, Renault made known the minute structure of every organ of the plant, and afforded a sure basis of comparison with other groups. The result was to show quite clearly that the characteristic Gymnosperms of Palæozoic times were not, as had been supposed before, members of the Coniferæ, but a quite distinct family, combining, in various respects, the characters of Coniferæ, Cycadaceæ, and the family which we now call Ginkgoales, represented in living vegetation by the Maiden-hair Tree alone. While stem and root on the whole present a Coniferous structure, the leaves, apart from their simple form, are almost purely Cycadean; the very peculiar male catkins (e.g. *Cordaianthus Penjoni*, above referred to) most nearly suggest those of *Ginkgo*, with which the female organs have likewise some analogies, though so far as the seed is concerned, a comparison with Cycads is equally admissible (Renault, 1879).

The investigation of the female fructifications yielded, perhaps, the most striking results of all, for here, in the pollen-chamber of the ovule (in *Cordaianthus Grand'Euryi*) Renault first found the multicellular pollen-grains to which so much interest attaches, and found evidence that their growth and differentiation went on after they had entered the ovule. To this subject we shall return in the following section.

The Cordaiteæ, this highly developed, but at the same time synthetic Gymnospermous family, extends back in time to the Devonian period, a fact always to be borne in mind by the palæobotanist, as showing the enormous antiquity, even of highly organised seed-plants, and thus inculcating caution in our phylogenetic speculations on their origin. Side by side with them, as we now know, lived a great multitude of Fern-like Spermophyta, with apparently far more primitive characters than the Cordaiteæ, but not, so far as has yet been proved, of greater antiquity. At the present stage of our knowledge we cannot doubt that the Pteridosperms represent most nearly the earliest type of Seed-plant, but this is a morphological inference, and is not as yet immediately given by the geological record.

The family of the Poroxyleæ, discovered by Renault (Renault, 1879), and fully investigated by him in conjunction with Professor Bertrand (1886), is of extreme interest, as tending to connect the Cordaiteæ with lower groups. Our knowledge is here, for the most part, anatomical, though M. Grand'Eury has once more stepped in, and is enabling us to recognise these plants in the form of impressions, and, as he believes, to identify their seeds.

The differences between this group and the Cordaiteæ cannot here be fully discussed; in general vegetative structure there is

an extensive agreement, but the stem retains a "Cryptogamic" character in the presence of strands of centripetal wood. Renault himself regarded the family as standing, on this account, a step nearer to the Lycopods; in the light of our present knowledge we should rather compare them with the Pteridosperms. However that may be, the extraordinarily perfect knowledge of their anatomy, which we owe to Renault and his colleague, has given the group a crucial significance in the discussion of Gymnospermous affinities.

5. Fossil Pollen-Grains.

In the course of his work with Brongniart on the wonderfully preserved silicified seeds of Autun and St. Etienne, Renault discovered the constant presence of a pollen-chamber—i.e. a definite excavation in the tip of the nucleus, adapted for the reception of the pollen-grains. Guided by his observations on Palæozoic seeds, he was able to detect the same organs in those of their nearest living allies, the Cycads, in ignorance of the fact that this discovery had already been made by Griffith, thirty, or perhaps even forty, years before. In the pollen-chamber of the various fossil seeds the pollen-grains, which were to effect their fertilisation, are often found in an excellent state of preservation, as we have already seen in the case of *Cordaianthus*. In this position especially, though also when still contained in the microsporangia, the pollen-grains proved, in many instances, to have a multicellular structure. This at least was the interpretation which Renault put upon the septate appearance which they present. Attempts have been made to show that the apparently multicellular structure is due merely to the occurrence of folds in a contracted inner membrane, but recent work has completely confirmed Renault's view, and in many cases, at any rate, there appears to be no doubt that a body consisting of several cells was really present within the pollen-grain. The analogy with the male prothallus and antheridium of a cryptogamic microspore is manifest, and was at once perceived by Renault. In the Gymnosperms of the present day, the corresponding structures, though present, are less conspicuously developed.

This discovery, so interesting in itself, led its author to form certain hypotheses as to the method of fertilisation, which are of remarkable interest in the light of subsequent results. In examining a seed named *Ætheotesta*, probably belonging to a Pteridosperm, Renault, in 1887, observed the minute structure of the multicellular pollen-grains in the pollen-chamber. He found that both in the outer wall of the grain, and in the septa between its cells, there were perforations. He suggests that the latter may represent the traces of insertion of multiple pollen-tubes, or—and

this is the important point—"that they served for the passage of mobile bodies analogous to antherozoids" (Renault, 1887, p. 156).

If the second hypothesis should be confirmed, "it would correspond," he says, "to an interesting phase in the evolution of plants which is absolutely wanting in the recent vegetable kingdom." At the close of the paper he adds: "We do not regard as impossible the existence in the past of pollen-grains, which, instead of effecting fertilisation by means of a tube, discharged into the pollen-chamber of the appropriate seeds antherozoids capable of performing this function" (p. 158).

Thus the study of the phenomena presented by Palæozoic fructifications led Renault to anticipate, by some ten years, the great discovery made at Tokyo by Ikeno and Hirase, that in the lower seed-plants the cryptogamic or animal mode of fertilisation by motile male cells still persists. The hypothesis was not one thrown out at hazard, but was deliberately entertained, as shown by Renault repeating it on other occasions still previous to the Japanese discovery (e.g. Renault, 1896, p. 276). The case affords a striking example, both of the acumen of Renault himself, and of the value of palæobotanical evidence in its bearing even on the more minute points of morphology.

M. Roche informs us that the scientific work left uncompleted at the time of Renault's death, relates chiefly to the fecundation and reproduction of permocarboniferous plants.

6. The Question of Secondary Wood.

In Dicotyledons and Gymnosperms, as we all know, both wood and bast possess the power of indefinite growth in thickness, by means of a layer of permanently, or periodically, active tissue, the cambium, which constantly adds new elements to both. On account of this method of increasing the mass of their vascular tissues, the name of Exogens was formerly applied collectively to the two classes in question. The capacity for exogenous growth, or as we now call it, the production of secondary wood and bast, is at the present time, no doubt, a great characteristic of the higher plants, though still by no means limited to them. Among the Vascular Cryptogams now living, instances of secondary growth in thickness are rare (e.g. *Botrychium*, *Isoetes*, and in a smaller degree *Psilotum*), and were not clearly recognised at the time when the structure of fossil plants first became the subject of scientific study. Hence, when the great Brongniart found that in *Sigillaria* and *Calamodendron* exogenous growth certainly took place, he was led to give up the view of their Cryptogamic affinities, and to class them with Gymnospermous Dicotyledons. The secondary wood, in fact, was looked on as a decisive Phanerogamic character, and

plants which possessed it were, *ipso facto*, identified as seed-bearing plants; the only question which remained was to determine the particular seeds which belonged to them, and on this quest much ingenuity was expended.

Brongniart's views were quite justified at the period when they were first expressed, and we cannot perhaps wonder that he, the greatest authority on everything relating to fossil plants, was unwilling to give them up. Although evidence rapidly accumulated showing that Palæozoic Cryptogams, such as *Lepidodendron* among Lycopods and *Calamites* among Equisetales, possessed secondary wood. Renault's loyalty to his great master prevented him, during most of his scientific career, from accepting these results. He endeavoured to draw a sharp distinction between the true Cryptogams, with which he classed *Lepidodendron* and *Calamites*, and the Phanerogams simulating them such as *Sigillaria* and *Calamodendron.* If evidence was adduced to show that a *Lepidodendron* produced secondary wood, Renault denied that it was proved to be a *Lepidodendron*, and transferred it to *Sigillaria.* A Calamite with the same character was placed in the Phanerogamic genus *Anthropitys* or *Calamodendron.* It so happened that our countryman Williamson became the great champion of the Cryptogamic nature of the Sigillarias and Calamodendreæ, and ultimately proved beyond doubt that the Lycopods and Equisetales of the Palæozoic generally possessed secondary wood, and were thus adapted to the arborescent habit which they so commonly assumed. Hence a warm controversy sprang up between the English school as represented by Williamson, and the French, among whom Renault was the leading spirit.

M. Zeiller, in his obituary notice of Renault (Zeiller, 1904) says: "His interest in the Equisetineæ and Lycopods was stimulated by his disagreement with Williamson as to the position of the Calamodendreæ and Sigillariæ, in which the secondary wood, centrifugally developed, seemed to him, as it did to Brongniart, to constitute a Phanerogamic character." This view is strikingly expressed, for example, in his *Stigmaria* memoir of 1882, where he speaks of the phanerogamic characters of the Sigillarias as "already established" by the structure of their vegetative organs. M. Zeiller continues: "Owing to the very fact of this disagreement, science has been enriched by admirable works from both sides, and if the facts have appeared to confirm the opinion of Williamson, the discoveries on the Pteridosperms recently made in England have gone to show how well founded was Renault's prescience, as to the existence of forms, similar in their outward aspect to certain types of Cryptogams, and yet belonging to Gymnosperms by their fructifications."

Renault's views became considerably modified in his later years, and he convinced himself (for he was very slow to be convinced by

others) that Cryptogams with secondary wood really existed—e.g. in the Calamarian *Macrostachya* (Not. sur les Calamariées, 1898). In fact, he came to regard both the Sigillarieæ and the Calamarieæ as transitional groups between Cryptogams and Phanerogams, some of their members approaching one side and some the other. Though we cannot now accept his conclusions in detail, the broad idea of the existence of such a "debatable land" in the Palaeozoic flora is an eminently fertile one. It is a striking fact that in some Lepidodendreæ, plants nearly allied to the Sigillarias, but which Renault would have placed on the Cryptogamic side of the line, organs closely analogous to true seeds have been discovered.

In his latest work (May 1904) Renault speaks of certain Calamarieæ as "Cryptogams with cambium" and thus definitely adopts the Williamson position, though, unfortunately, without recognising Williamson's work in establishing it. At the same time he still inclined to attribute seeds such as *Stephanospermum* to plants of the Calamarian group. There is no objection in principle to this conception of the existence of spore-bearing and seed-bearing members of the same family—it is to a great extent realised, as we now know, among the carboniferous Lycopods. In the case of the Calamarieæ, however, the evidence for the occurrence of the seed-bearing habit is as yet very inadequate. It is, in any case, a gratification to an English palæobotanist to realise that, at the close of Renault's career, there was no longer any fundamental difference of view between himself and his fellow-workers in the same field.

The illustrations of Renault's great work which I have selected, may serve in some degree to indicate his place in the history of science, but are altogether inadequate to give any idea of the extent of his labours.

Even in the particular field which we have rapidly traversed, investigations of the highest importance have been left untouched, as, for example, his first demonstration of the structure of *Sphenophyllum*, representing a wholly extinct class of Cryptogams; his magnificent investigation of the organisation of Calamarian fructifications; his work on the Cycadoxyleæ, a family perhaps intermediate between Pteridosperms and true Cycads; his detailed anatomical studies on *Sigillaria* and *Stigmaria*; and other researches too numerous to mention.

Besides all this, there is the vast mass of work of his later years on the micro-organisms of Palæozoic age, to which an incredible amount of labour was devoted. The investigation of fossil Bacteria, at any rate, appears a somewhat thankless task; in favourable cases, as, for example, that of *Bacillus vorax* (Renault, 1896, p. 472) occurring in vegetable débris of Lower Carboniferous age, there appears to be no doubt as to the nature of the organism, which

shows the spores enclosed within its cells; in other cases, however, the meagreness of the morphological characters available for the distinction of fossil Bacteria, leaves us in some doubt as to the value of the results attained.

Renault's work further extended to the investigation of Tertiary floras. The remarkable stained wax casts which he obtained of fossil flowers and fruits from the travertine of Sézanne, are an interesting feature of the Museum Collections.

His reputation, however, will always rest mainly on his study of the higher Palæozoic plants by the anatomical method, a line of work the full value of which has only begun to be recognised by botanists within the last few years.

As investigators, Renault and his distinguished English rival Williamson had much in common, not only in their like enthusiasm and devotion to their work, but also in a certain obstinacy when confronted with the opinions of others, combined with complete honesty and openness of mind in accepting the results brought home to them by their own observations.

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Only a few of Renault's most important works, and those specially cited, are given. A very full bibliography, with a *résumé* of many of his works by Renault himself, and selected illustrations, will be found in M. Roche's "Biographie," cited below.

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III.—On an Improved Form of Metallurgical Microscope.

By Walter Rosenhain, B.A. (Cantab), B.C.E. (Melbourne).

(Read February 21, 1906.)

Plate VI.

The importance which the microscopic study of metals has steadily acquired during the past ten years has led to the development of a sp·cial form of Microscope suited for the requirements of this class of work; the development of these instruments has, however, been almost entirely confined to progressive modifications of the standard type of Microscope as used for other purposes. While it is undoubtedly possible to obtain very satisfactory results in the study of metals by means of a good Microscope of the ordinary type, provided with certain special attachments, limitations and disadvantages soon become evident, and even the most specialised metallurgical Microscopes hitherto available do not overcome the most serious of these difficulties. On the other hand, as the author has endeavoured to show elsewhere,* the design of the standard Microscope does not, in certain respects, satisfy the demands of correct mechanical design; and while it may, perhaps, be fairly urged that the optical requirements necessitate the sacrifice of mechanical perfection, such a contention does not apply to the metallurgical Microscope, which is intended primarily for the examination of opaque objects by reflected light. These considerations have led the author to design the instrument here to be described, on lines which differ very considerably from those of the standard type of Microscope.

The main differences between the requirements of the ordinary Microscope and the instrument intended for metallurgical purposes arise from the fact that the apparatus for the use of transmitted light, which is so important in the former, is not required at all in the latter, while, on the other hand, the appliances known as vertical and oblique illuminators are essential for metallurgical work and are rarely used for other purposes. Further, the specimens to be examined with the metallurgical instrument are sometimes of considerable weight and size, and it may be desirable to examine them by means of long-focus lenses (3-inch), so that a very wide range of separation between stage and objective is required. In the older metallurgical Microscopes this last requirement has

* "The Mechanical Design of Instruments," by W. Rosenhain, Proc. Optic Convention, London, May 1905.

Rosenhain Metallurgical Microscope.

[*To face p.* [illegible]

been met by applying a rack-and-pinion focusing motion to the stage of a Microscope of the ordinary type. An additional advantage was also secured in this way by making it possible to keep the aperture of the vertical illuminator attached to the lower end of the body-tube in one position, for which the illuminant and condensers, or optical bench, had been properly and permanently adjusted. Taking a further step in the same direction, the author has designed the present instrument with a body-tube rigidly fixed to the limb of the Microscope, both the coarse and the fine adjustment being applied to the motion of the stage.

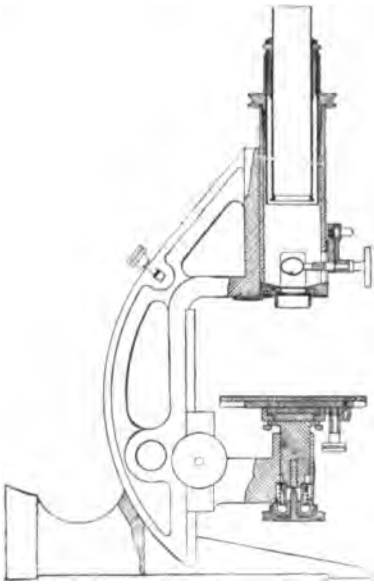


Fig. 21.

The general appearance of the instrument will be readily gathered from the illustrations, plate VI. and figs. 21 and 22, which show the Microscope in three positions; it will, therefore, only be necessary to describe the details of the various special features of the instrument.

Base and Limb.—The base is approximately triangular in plan, and has been designed to give the greatest possible stability with a minimum weight, while allowing perfectly free access to the milled heads attached to

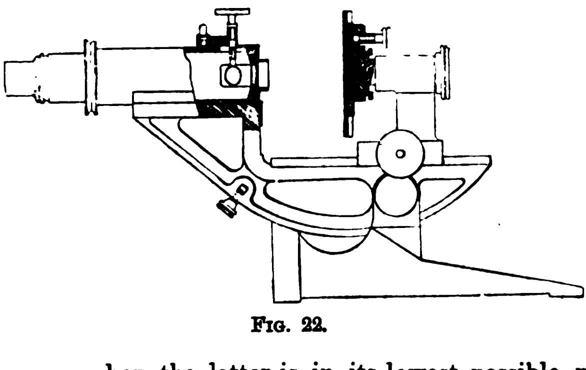


Fig. 22.

the stage, even when the latter is in its lowest possible position. A portion of the base projects, and is so shaped as to provide a firm bearing for the limb when the Microscope is being used in

a horizontal position, as for photography, a very great degree of rigidity being thereby secured in the position where it is most required. The height required for this foot or support is kept low by hinging the limb about an axis placed only 78 mm. (3 inches) above the base; this axis is made very massive, in order to secure both ample stiffness and to provide a large bearing surface, so that, with a good fit, the friction is sufficient to sustain the limb at any angle, more especially since the position of the axis is such as to bring the centre of gravity of the inclinable portion of the instrument vertically above the axis at an inclination which only differs slightly from 60°, according to the position of the stage. In the vertical position, the limb itself bears against a recess suitably formed in the base. In practice, the entire instrument may be readily carried about by means of the handle provided in the limb, without fear of displacing anything—even with a high-power objective, the focus remains in adjustment. The limb itself is made of a deep T-girder section, the broad flange of the T forming the bearing for the large dovetailed slide which carries the stage, and also providing a rigid attachment for the tube. The depth of the T is proportioned to the bending stresses likely to be developed by the weight and manipulation of the instrument, the back of the limb thus assuming a curved outline. The web of the T section is cut away in two large openings, thus saving weight and reducing the whole limb to a close approximation to a rigidly braced girder while one of the openings provides a most convenient handle, by which the entire instrument may be safely lifted.

The Stage.—The stage is carried by a stiff bracket attached t a massive slide, moving, by rack and pinion, along the broad flang of the limb; the milled heads attached to the pinion—which consti tutes the coarse-adjustment of the Microscope—are carried on lon stout stems, so as to clear the base when the stage is racked down in the vertical position the separation available between the en of the body-tube and the stage surface is 95 mm. (3¾ in.), while the instrument be slightly inclined, this may be increased 120 mm. (4¾ in.). An important advantage of the constructic here described lies in the fact that the relative position of sta and tube is as rigidly secured with the largest separation as wh the stage is close up to the tube; in the older instruments, soon as the body-tube is racked up to any considerable exte the bearing between tube and limb is reduced, and a serious amou of looseness results.

The stage bracket carries at its outer end, concentric with t optic axis of the instrument, the fine adjustment. The details a construction of this portion of the instrument are exactly simi to any good fine-adjustment, except that the whole arrangement inverted, and the moving plunger carries the stage direct. great advantage of this arrangement is that all the weight t

comes upon the fine-adjustment is carried centrally, while any slight irregularities of bearing surfaces or motion are not magnified, as in the ordinary construction, by a considerable overhang of the moving parts; the resulting fine-focusing motion is consequently remarkable for a crisp decisiveness and absence of all wavering which is most refreshing in use, while the favourable conditions of wear under the circumstances described should go far to lengthen the life of the more delicate parts.

The stage itself combines all the advantages of a simple flat stage, free from all encumbrances upon its surface, with complete mechanical movements and complete rotation about the optic axis. This result is secured by placing the mechanical stage movements below the stage plate itself; the movements themselves consist of two broad dovetailed slides, at right-angles to one another, actuated by rack-and-pinion movements controlled by milled heads fixed below. Even when an inch of mechanical movement has been used, the stage may still be completely rotated. The author regards a stage capable of such complete rotation and free from all encumbrances upon its surface as almost essential to the better class of metallurgical work; the interpretation of the microscopic images is often only possible by the use of various forms of oblique illumination, some of which will be mentioned below, and when these are applied it is usually necessary to test the effect of varying orientation of the specimen by rotating the stage; under such circumstances it leads to much annoyance and loss of time to find that the rotation is blocked, or the light obscured by a projecting fitting on the stage, just at the point which it is most important to observe. Another advantage of the arrangement of movements adopted in the present instrument is to be found in the fact that all the milled heads regulating the focus and the position of the specimen lie within easy reach of one hand; thus it is quite easy to use one of the mechanical movements of the stage with the thumb and one finger, while keeping the object in focus by moving the fine-adjustment with the little finger of the same hand, particularly as the wrist may rest comfortably on the table if the instrument is not too much inclined.

In the instrument as at present constructed the rotation of the stage is provided with neither centring screws nor mechanical movement, a firm clamp, acting in any position, being alone provided. The centring screws have been omitted in order to economise space, a centring nose-piece being provided as an integral part of the body-tube, while the author does not consider that mechanical rotation of the stage is essential for metallurgical purposes.

The Body.—As has already been indicated, the tube of the Microscope is rigidly attached to the limb, all focusing motions being carried out by means of the stage. A considerable increase of

rigidity results from this arrangement, and it is particularly convenient that manipulations at the eye-piece end of the tube may be carried out freely without fear of disturbing the focus of the objective or even—as sometimes happens—accidentally pushing the body-tube bodily down upon the specimen; where it is desired to attach a small camera to the Microscope body direct, this rigidity would also be a great advantage.

In the present instrument the body is made of unusually thick tube, and thus serves to support the necessary illuminating apparatus by means of slides placed outside three apertures opening at the front and both sides of the lower end of the tube.

The Illuminator.—In all metallurgical Microscopes hitherto constructed, with the exception of a peculiar instrument designed by H. Le Chatelier, the illuminator has been employed as a detach· able fitting; in the present instrument, the illuminator is an integral part of the body-tube. The advantage secured by this means lies in the absence of a movable attachment intervening between the objective and the tube and inevitably introducing a certain amount of looseness. In the present instrument the objective is screwed direct into the lower end of the body-tube, o into a centring nose-piece directly placed in the end of the tube In addition to the gain in rigidity, this arrangement makes it eas to interchange one illuminating appliance for another without i any way disturbing the focus of the objective, while with the olde arrangement a change could only be made by removing th illuminator and objective; the new instrument thus provides valuable facility for investigating the effects of different method of lighting upon the microscopic appearance of various structures- a process likely to lead to valuable results in interpretation.

The illuminator proper consists of a short slide fitting in any of the three sets of dovetails corresponding to the three ope ings of the tube; to the slide itself is attached a short swingi arm carrying a spindle capable of rotation with slight frictio When the slide is in position, the spindle projects horizontally in the tube, the outer end being furnished with a substantial mill head. The inner end of this spindle is provided with an axi hole, into which the small holders with various reflectors fit int changeably. By moving the slide up and down, by moving t swinging arm backwards or forwards, and by rotating the mill head, the reflector may be placed in any position or at any desi angle. These adjustments are of the greatest value in securi uniform illumination and the suppression of undesirable inter reflections, while special modes of illumination, correspondi somewhat to the dark-ground effects with transmitted light, m be obtained. For the most brilliant and uniform illuminati with a minimum of internal reflections, the author finds a reflec of thin silvered glass, placed so as to cover a little less than

the aperture of the objective, by far the best, giving decidedly better results than the prism illuminator which is so much employed. In order, however, to enable the observer to study the effects of oblique lighting with high-power wide-angle objectives, a whole series of reflectors of different shapes and sizes is provided for the instrument; these are illustrated in fig. 23.

It has already been pointed out that the illuminator slide fits into the dovetailed grooves provided outside each of the three openings in the body tube, so that the Microscope can be placed in any of the three positions relatively to the source of light; once the relative position of Microscope and illuminant has been properly adjusted, no change will be required when objectives of different foci, or specimens of different thickness, are used. Interchangeable with the illuminator slide, a series of other slides is provided. One of these carries an iris diaphragm on a swinging arm; this is inserted on the side facing the illuminant, and serves

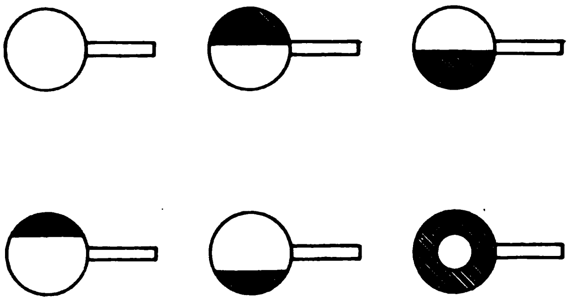


FIG. 23.

to stop down the incident beam, if required; the use of the slide and of the swinging arm making it possible to adjust the aperture of the iris to the position found most desirable for the reflector of the illuminator. The ring carrying this iris is also fitted with a standard objective screw-thread, by means of which lenses may be attached; perhaps the most important use of a lens applied at this point is the application of a negative lens for the purpose of producing critical illumination. In the ordinary course the best means of obtaining critical illumination for opaque objects, is to employ a source of light of considerable area, such as an incandescent gas burner with an opal chimney, and to place this source of light on a level with the aperture of the illuminator and at a distance from the reflector of the illuminator equal to the distance from the reflector to the back conjugate focus of the objective. Under these circumstances, the image of the source is formed by the objective itself upon the surface of the specimen. The image of the source, as formed by the objective at the eye-

piece end, is then the full natural size of the source, and is seen by the eye magnified by the eye-piece only. By using a large source as indicated above, the whole field can be uniformly illuminated, and in the author's experience such lighting is preferable to any other for all "vertical illumination" work on metals. If a small source of light is used, such as an electric arc, this direct method is not available, particularly as it would not be practicable to bring an arc so near the Microscope. One means of attaining the desired object is to utilise the light of the source, by means of a suitable system of lenses, to form a small bright disk of the required size, upon a translucent screen placed at the proper distance from the Microscope, and then to use the image of this screen for critical illumination. Another method is to throw a real image of the source to a point close to the illuminator aperture and then to interpose between the image and the illuminator a suitable negative lens giving an enlarged virtual image of the source at the proper distance from the illuminator; with a proper choice of foci for the various lenses, it is possible in this way to obtain a critical image of the arc large enough for the image of one crater to fill the field as seen by the eye or in the camera; but such spreading of the light necessarily entails loss of intensity, so that the use of critical illumination for photo-micrography of metallic specimens still entails some difficulties. For visual purposes, however, it not only yields the best results, but also furnishes the simplest method of illumination, no condensers whatever being required if a large source be used.

With objectives of focal lengths up to about 25 mm. (1 in.) the use of the internal reflector or "vertical" illuminator furnishes the most satisfactory results; but from that focal length onwards the distance between objective and specimen is large enough to allow of the use of external reflectors. If normal illumination is required it can be obtained by interposing a reflector between the objective and the specimen. The advantage of doing this is that all internal reflections are avoided, and a beam of wider angle can be condensed on the specimen by suitable condensers than could be obtained from these long-focus objectives. The external reflector may take the form either of a thin glass slip covering the entire field of view and inclined at about 45° to the optic axis, or it may take the form of either a metallic reflector (Sorby), or a silvered glass reflector covering about half the aperture of the objective. So far as the author's experience goes, the thin glass reflector gives the most uniform illumination, but its presence distinctly interferes with the definition. In the present instrument any of these reflectors may be carried on the lower end of a long slide which fits into the grooves outside the illuminator openings of the body tube; the lower end of this slide carries a wide ring completely surrounding the objective, but out of contact with it, and upo

this ring the mountings of the various reflectors can be slipped; the reflectors are thus held independently of the objective, so that the fitting of adapters to various objective mounts is obviated, while the height and position of the reflectors can be varied at will. For general oblique illumination a silver parabolic Lieberkuhn is frequently used, and this is mounted to fit upon the outside of the ring at the lower end of the slide just described. With this Lieberkuhn in position, a fitting for other reflectors may be placed inside the ring carried by the slide, and to this fitting any of the reflectors already described for use above the objective, may be readily fitted.

Although the parabolic Lieberkuhn is much used for general oblique illumination, and certainly gives some very pleasing effects, the author regards it as a somewhat undesirable form of illuminating appliance, because its indications are very difficult to interpret; the light is focused upon the object from a great number of directions, and all surfaces inclined in such a way as to throw any of this light into the objective accordingly appear more or less bright. For this reason the author prefers to employ oblique light falling upon the specimen—if not as a strictly parallel beam, yet at least from one general direction. Rotation under such lighting frequently enables the observer to form correct judgments as to the relative heights and inclinations of various portions of the field. Sometimes the relative orientation of different crystals, or other surface markings, may be shown in a very striking manner by the simultaneous use of three beams of oblique light incident upon the specimen from three different directions, and distinguished from one another by their colour. For this purpose beams of light from three sources may be focused upon the specimen and coloured glasses interposed; in the present instrument this is facilitated by means of three slides for holding the coloured glasses or films, these slides again fitting the three sets of dovetail grooves in the body-tube.

Eye-piece Focusing Attachment.—When a visual eye-piece is used for purposes of photo-micrography, it is usual to focus the objective on the field visually, the objective being arranged to work at its proper tube-length under those conditions; the alteration of focus which is required to yield a real image on a screen is then obtained by altering the distance between the objective and the object, thus tending to throw the primary image formed by the objective to a point further from the eye-piece end of the tube. In doing this the objective is caused to work at a tube-length which is considerably shorter than that for which it is best corrected, so that its optical performance is impaired to some extent. If the eye-piece in question is of such a construction that the real image from the objective is actually formed in the tube outside the eye-piece, then the proper method of changing the focus

from that required for direct vision to that required for photographic projection, will obviously be to move the eye-piece outwards until the image formed by the objective lies sufficiently far beyond the principal focus of the eye-piece. Some eye-pieces are constructed in this way, being simply aplanatic magnifying glasses; in the commonest case, however, of the Huyghenian eye-piece, the rays from the objective pass into the collecting lens of the eye-piece before actually coming to a focus, and for these eye-pieces the rational mode of focusing for photography would be to move the back lens of the eye-piece only, provided that this lens were individually corrected adequately as a photographic lens. A near approach to this state of affairs is attained in the projection eye-pieces supplied with a focusing scale, but even with these, the use of the fine-adjustment is still required for focusing accurately. In order to obviate the derangement of the objective when the

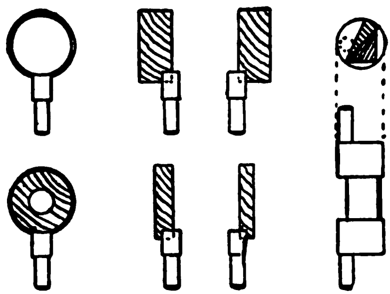


Fig. 24.

instrument is required for photography, the present Microscope i fitted with a spiral focusing motion which enables the operator t focus by moving the eye-piece alone—a process which makes i possible to use ordinary eye-pieces for photographic purposes in much more rational manner. The movement of the eye-piece actuated by the rotation of a milled collar at the upper end of th fixed body-tube, and this collar is grooved for the reception of driving band, whereby the operator can focus while observing tl ground glass screen of the camera.

While the design of the instrument here described has be arrived at entirely with the aim of providing an instrume specially perfected for metallurgical purposes, it is recognised th it may be desired to use the instrument for the examination sections or other objects by transmitted light. For this purpose special attachment is provided, consisting of a bracket which c be attached to the stage bracket, carrying a right-angled reflecti prism, iris diaphragm, and a swing-out condenser, with spi focusing motion, together constituting a high-class illuminati

system. Upon the stage itself, and therefore partaking of its mechanical movements, is fixed a second or raised stage with apertures to fit over the condenser just described. With this attachment the only disadvantage is that the range of separation between tube and stage is diminished by about 50 mm. (2 inches), but since the maximum separation is still 70 mm. (2¾ inches) this diminution will hardly be felt for work with transmitted light. All the advantages of extreme rigidity and concentric fine-adjustment are of course retained when the instrument is used for transparent objects, so that where one instrument is to be used for both classes of work, the considerable gain for the study of opaque objects which this Microscope is believed to afford, would more than outweigh the slight disadvantages, if any, which will be found in using it for transparent objects.

In conclusion, the author would express his indebtedness to Messrs. R. and J. Beck, Ltd., for the skilful manner in which they have worked out all the details of the instrument from the sketches and specification supplied to them.

NOTES.

Photography of Diatoms.

By T. A. O'Donohoe.

Plate VII.

At the January Meeting I exhibited three photographs of *Pleurosigma angulatum*, and one each of *Surirella gemma* (black dots), *Amphipleura pellucida*, *Coscinodiscus asteromphalus*, and *Podura* scale. These were all taken direct at an amplification of 2000 diameters, except the *Amphipleura pellucida*, which was magnified 1500 times. Two photographs of the *Pleurosigma angulatum* were further enlarged to 3700 times.

The illumination was furnished by an ordinary oil lamp with ⅝ in. wick. Watson's parachromatic condenser was used to procure direct axial cones, except in the case of the *Amphipleura pellucida*, for which Watson's immersion condenser N.A. 1·30 was used to obtain the necessary oblique illumination.

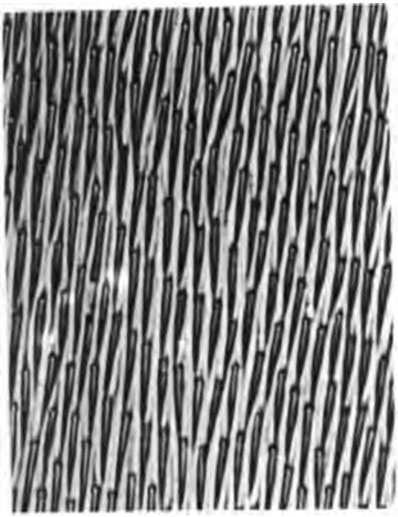
The exposures ranged from 2 hours without a screen, as in the case of the *Pleurosigma angulatum* herewith reproduced, to 6 hours with the F line screen, as in the case of the *Podura* scale also reproduced. These long exposures of course necessitate a very good fine-adjustment in the stand. Mine is the portable histological stand made by Swift for and exhibited by Mr. E. M. Nelson at the meeting of the R.M.S., held December 18, 1895.

It is fitted with Campbell's differential screw. The lens used is a Zeiss apochromatic 2 mm. N.A. 1·30 with a Zeiss 4 compensating ocular, as my 2 projection ocular would not give the required amplification.

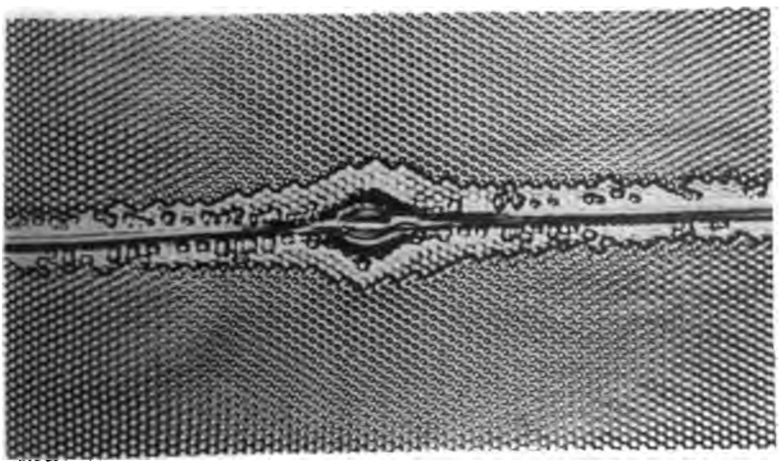
I use an enlarging camera, costing a few shillings, extending to 40 inches and sliding on a home-made optical (?) bench fitted with a home-made fine-adjustment, which answers well enough for low-power work, but which was detached altogether in taking the photographs now under consideration.

I focused in the air with an achromatic hand reading-glass, and passed backward and forward, touching the fine-adjustment of the Microscope until the desired result was obtained. This process requires patience and perseverance—two excellent qualities to acquire.

For the *Podura* scale and *Coscinodiscus asteromphalus* I used an axial cone of 0·5; for the *Pleurosigma angulatum*, 0·65; for the



PODURA SCALE.



PTEUROSIGMA ANGULATUM.

T. A. O'Donohoe, Phot.

Surirella gemma, 0·75; and 1·30 with crescent stop for the *Amphipleura pellucida*.

The *Pleurosigma angulatum*, *Surirella gemma* and *Amphipleura pellucida* were taken from the yellow (realgar?) mounts of Thum. The *Coscinodiscus asteromphalus* was mounted in styrax.

The Barnet extra rapid orthochromatic plates were mostly used.

Dark Field Illumination.

By J. W. Gordon.

When lecturing at the Royal Institution on February 10 last, I demonstrated the production of dark field illumination in a picture thrown by a projection Microscope, the darkening of the field being, in fact, produced by the introduction of a diffraction fringe. My object was to obtain the improved resolution, which is, on theoretical grounds, to be expected on a background illuminated by diffracted light; but, in fact, I found in rehearsal that I obtained such strongly accentuated representation of refracting surfaces, that I was obliged to confess that the experiment succeeded too well, and the result which I had looked for was masked by an unexpected effect, which at that ime I could not explain. The experiment seemed to me to be none the less interesting on that account, and I therefore showed it as a matter of curiosity, believing that I was then demonstrating it in public for the first time.

A week or two later I lighted by chance upon a reference which sent me to a paper contributed by Professor Töppler to Poggendorff's Annalen for the year 1867 (p. 33), and there I found my experiment described, with immaterial variations, and fully and most lucidly explained.

It then appeared that the diffractor which I had been using was equivalent to a post-objective stop. In the case of the projection lantern the objective angle was considerably wider than the condenser angle, and therefore dark field illumination could not have been obtained—if I had tried to get it—by the usual expedient of a stop in the aperture of the condenser. But for the same reason, a stop shutting out the middle of the objective darkens the field, while allowing strongly refracted rays to pass round its edge in the marginal zone of the objective; and thus an alternative position was indicated for the dark field stop available for use with objectives of high N.A.

This was to me a new and highly interesting light upon the subject of the illumination of the microscopic object, and, having the good fortune to fall in with Professor Wright, I mentioned the matter, and Töppler's paper of 1867, to him. He quite shared my interest in Töppler's paper, but told me that the post-objective stop had in fact been made and used, although not extensively. But our discussion of the subject did not end there. We considered how far the generalisation could be carried which enabled the microscopist to choose alternative positions, suitable to the specific requirements of his optical system, for his dark field stop; and the theory of the matter, when considered from that point of view, very soon yielded the following deductions.

1. The stop must be placed where the aperture of the instrument is largest, when measured by its projection on the image plane of the instrument.

2. Whether placed in the aperture of the condenser or in that of the objective, the stop will be imaged in the Ramsden circle of the instrument.

3. If a small opaque disk, having the shape and dimensions of that projected image of the stop, be placed in the exact position occupied by the image, and the original stop be removed, the new disk will shut out exactly the same field light which the original stop shut out in its original position, and so will produce the same dark field in the observer's eye.

4. Here is a very convenient and very simple apparatus for producing dark field illumination; for a small stop can easily be mounted in a suitable position over the eye lens and, so placed, will serve to produce dark field with wide-angled lenses. It is obviously unsuitable for narrow-angled lenses, since in that case a stop at the top of the instrument would cut off some—or all, in the case of a full-sized stop—of the light intended to enter the eye.

These we considered to be conclusions of so great importance as to demand full experimental verification, a task which I undertook, and have now brought to a stage in which I venture to think that the results will be of interest to the Fellowship of the R.M.S. Accordingly, I have now to report as follows:—

1. A convenient form of stop for use in this way is easily made by breaking up a small mass of mercury into globules, and mounting one of these globules on a cover-glass held in the exact plane of the Ramsden circle. For permanent use the globule may be mounted in balsam between two cover-glasses. The precise level is of great importance. Above or below it, the stop appears as a blemish in the optical field, with dark field edges and an opaque centre. Accurately placed in the Ramsden circle, it darkens the whole field evenly and is nowhere opaque. It may be centred or placed excentrically for the purpose of obtaining symmetrical or asymmetrical illumination, as required.

2. The size of the stop must be determined with reference to the size of the Ramsden circle, and to the particular result required. I find a range of globules running from $\frac{1}{200}$ in to $\frac{1}{20}$ in. very convenient, the steps varying by $\frac{1}{200}$ in. among the smaller members of the series, and $\frac{1}{100}$ in. among the larger. A stop equal in size to the Ramsden circle gives a black field, upon which only such details are shown as represent highly refractive bodies or objects having a geometrical structure which can be imaged by their own diffracted light. A *Pleurosigma angulatum* depicted in this latter way, when the central beam is entirely shut out by a top stop covering the whole Ramsden circle, is one of the most beautiful objects that can be presented to the eye. A smaller stop will produce darkening of the field and some degree of strengthening of the definition, and may be very advantageously employed to moderate the glare of excessive illumination. The great advantage of a central stop for this purpose as compared with the common alternatives—as compared, that is to say, with closing down the iris diaphragm or racking down the condenser—arises from the circumstance that moderation of the light is obtained by means of the central stop without any loss of resolving angle, and also with some actual increase of defining power.

3. Beside the common purposes of producing dark ground, and controlling the illumination to which these top stops can be applied, there is another, which seems to contain the promise of future achievements. By working the iris diaphragm against the stop, it is possible to produce a thin hollow cone of light, which has an extraordinary power of bringing out the stereoscopic detail of an object. Blood corpuscles seen in this way, for example, are no longer flat rings, but rounded forms with sculptured surfaces. Indeed, it was for this precise effect that Töppler devised his experiment, and few experiments have succeeded more completely. No microscopist will ever forget the first time that he looks under these conditions of illumination into the internal structure of a *Triceratium favus* mounted dry.

Mr. Nelson, to whom I have communicated the substance of the above statement, is good enough to furnish me with a reference to this Journal for 1878, page 186, where there is a Note by the late Mr. J. W. Stephenson upon the appearance of *P. angulatum* when seen under a wide-angled lens with a stop placed immediately behind the objective to shut out the dioptric beam. But Mr. Nelson adds that stops of this kind, although they had a vogue about that time, soon after went out of use. That this should be the case is quite easy to be understood. The necessary adjustments cannot possibly be made with a stop placed on the tube of the Microscope; and the actual experiment which Mr. Stephenson demonstrated—of showing an object by its own diffracted light—although extremely pretty,

involves so much false colour and spurious detail as to be of no practical value. The real merit of a post-objective stop is to give accentuated value to the *widely-refracted* light on the principle explained in Töppler's paper, and its practical value in this way can hardly be overstated. But the only practicable position in which to mount it is just above the eye-lens in the Ramsden disk.

SUMMARY OF CURRENT RESEARCHES

RELATING TO

ZOOLOGY AND BOTANY

(PRINCIPALLY INVERTEBRATA AND CRYPTOGAMIA),

MICROSCOPY, ETC.*

ZOOLOGY.

VERTEBRATA.

a. Embryology.†

Improved Method of Artificial Parthenogenesis.‡—Jacques Loeb has combined a solution of sodium-chloride with ethyl acetate, and finds that the combination is so effective in inducing artificial parthenogenesis that 100 per cent. of the eggs develop. The effective factor in the ethyl acetate seems to be the acetic acid.

Formation of Centrosomes in Enucleated Egg-Fragments.§—N. Yatsu finds that enucleated fragments of the eggs of *Cerebratulus lacteus*, subjected to calcium chloride solutions, form rayed systems, including centrioles. It is not possible to induce the formation of rays before the nucleus has resolved itself to form the first directive spindle.

Origin of a Rete Mirabile.‖—J. Tandler has studied the development of the arterial rete mirabile in the sinus cavernosus of the pig. It arises by budding from the wall of a primarily simple vessel, not from the persistence of capillaries. In more general terms, the network is due to secondary formation, not to the persistence of an embryonic condition.

Development of Primitive Kidney in Chick.¶—E. Grafe has investigated some points in the development of the kidney and its vessels.

* The Society are not intended to be denoted by the editorial "we," and they do not hold themselves responsible for the views of the authors of the papers noted, nor for any claim to novelty or otherwise made by them. The object of this part of the Journal is to present a summary of the papers *as actually published*, and to describe and illustrate Instruments, Apparatus, etc., which are either new or have not been previously described in this country.

† This section includes not only papers relating to Embryology properly so called, but also those dealing with Evolution, Development, Reproduction, and allied subjects.

‡ Univ. California Publications, ii. (1905) pp. 83–6, 89–92.

§ Journ. Expér. Zool., ii. (1905) pp. 287–312 (8 figs.). See also Zool. Zentralbl., xii. (1905) p. 551.

‖ Verh. Anat. Ges. xix. Vers. See also Anat. Anzeig., xxvii. (1905) Erg. heft, pp. 158–5.

¶ Arch. Mikr. Anat., lxvii. (1905) pp. 143–230 (5 pls. and 17 figs.).

There is in the genital part of the primitive kidney an increase of malpighian bodies and tubules. These new formations arise by budding of the Wolffian duct or of the primary tubules, and break through, secondarily, into the Bowman's capsule. Only a few subsequently get into connection independently with the Wolffian duct. The malpighian bodies increase by division of the primary ones. The formation of the glomerulus of the secondary malpighian bodies does not go on *in loco*, but is effected by a budding of the primary vas afferens. The vasa efferentia originate the venous network of the primitive kidney. Other points are considered in the paper.

Three-weeks' Human Embryo.*—S. P. Gage describes an embryo of this age, from a study of which she notes several interesting points. There are twenty-nine myotomes. The developmental stage of the central nervous system shows with definiteness the position of the neuropore and its relation to the hypophysial region, from which it is possible to determine the front end of the brain-tube and of the body. This is in the region of the hypophysis, and consequently parts which in the exigencies of growth have gone beyond this point are morphologically posterior to it, e.g. the eye and olfactory region.

Embryology of Sturgeon.†—A. Ostroumoff describes the development of the cloaca and urinogenital sinus in *Acipenser ruthenus*. The cloacal opening and the communication of the Wolffian ducts are in existence in the stage with 30 somites, i.e. 70 hours after fertilisation. The cloaca consists of two divisions separated by an intra-cloacal membrane: a hinder one opening ventrally outwards, and communicating on both sides with the Wolffian ducts, and an anterior one in communication with the gut cavity. The hinder division represents the origin of the sinus urinogenitalis. Dorsalwards, this division is in close communication with the anterior end of the tail-gut, which directly opens into the gut cavity. Later, the connection between sinus and tail-gut is interrupted by the in-pushing of the intra-cloacal membrane; still later, after hatching, the communication between the tail-gut and hind-gut is obliterated, and the tail-gut disappears.

Immunity of Fœtus.‡—A. Kreidl and L. Mandl find, as the result of an experimental study upon goats, that the fœtus in the later stages and the newly-born young react to treatment with ox-blood with the formation of a specific hæmolysin.

Topography of Human Fœtal Pancreas.§—C. M. Jackson gives an account of this, based upon a study of fifty examples, ranging in age from two months up till full time. The various modifications of form and position of parts at different stages of growth, are fully treated. In the earlier stages of development, the body of the pancreas appears somewhat flattened in form, with anterior and posterior surfaces. The inferior surface develops through contact with the underlying intestines

* Amer. Journ. Anat., iv. (1905) pp. 409–43 (5 pls.).
† Zool. Anzeig., xxix. (1905) pp. 515–7 (2 figs.).
‡ SB. Akad. wiss. Wien, cxiii. (1904) pp. 285–306.
§ Anat. Anzeig., xxvii. (1905) pp. 488–510.

in the third month, the inner portion appearing first, the outer slightly later. From the third month onward the body of the pancreas is (wholly or partly) prismatic in 90 p.c. of all cases.

Development of Dentine in Mammalia.*—K. v. Korff finds that the ivory cells do not share in forming the collagenous dentine ground-substance, but that they develop, by means of a secretory activity, only the tooth-fibres which keep open the nutritive canals, i.e. the dentine canals. The dentine at first is not homogenous, but is composed of fibrils of connective tissue of the tooth pulp. The fibrils radiate peripherally towards the upper surface of the pulp, and become felted with the fibrils of the basal membrane which lies upon the enamel-cells. The basal membrane thickens by the addition of fibrils which are always growing from the interior of the pulp. In the zone of the ivory-cells the fibrils of the pulp pass into the spaces between them. They here form intercellular collagenous strands which split into fibrils, and these merge into the fibrils of the dentine ground-substance.

Development of Lungs in Tropidonotus.†—J. J. Schmalhausen has studied this in *T. natrix*. In the adult a small left lung (2–4 mm.) is present, which has a typical snake's lung structure, and is connected with a bronchus provided with cartilaginous rings. Both lungs arise simultaneously, or almost so, but the right grows very much faster than the left, whose growth extends throughout the whole embryonic period. In connection with the strong development of the right lung, there is a displacement of the gut to the left and ventralwards, besides a twisting of the right lung upon its axis, so that the left lies upon the ventral face of the right. Histological differentiation also proceeds more rapidly in the right than in the left lung. All this is in accordance with Mehnert's formula, according to which the origin of retrogressive organs tends to be later, and their development and histological differentiation is slower than in progressive ones. The latter, contrarywise, are subject to a hastening of the processes of development, which expresses itself in the earlier origin, in the more rapid succession of one histological stage after another, and in the rapid increase in size of the organ. The left lung in *T. natrix* is a good example of the greater variability of a rudimentary organ, e.g. it exhibits variation in its rate of growth and in its time of origin.

Development of External Genitals of Sheep.‡—J. Böhm finds that the first appearance of the sexual organs in the sheep is in embryos of 1·1 cm. The phallus ridge is not ectodermal, but endodermal in origin. The epithelial lamellæ of the phallus ridge do not diverge, hence there arises neither a sex groove nor distinctly projecting sex folds. The sinus urogenitalis never opens out into a sex groove. The male sexual organ does not arise by longitudinal growth of the genital protuberance, but the small phallus is displaced navel-wards, and transformed into glans and plandarium. The urethra arises by energetic growth of the endodermal basis, independently of the raphe. The female phallus

* Arch. Mikr. Anat., lxvii. (1905) pp. 1–17 (1 pl.).
† Anat. Anzeig., xxvii. (1905) pp. 511–20 (8 figs.).
‡ Morphol. Jahrb., xxxiv. (1905) pp. 248–320 (2 pls. and 60 figs.).

is differentiated into clitoris and clitorium. The urogenital orifice is not to be characterised as the sexual groove. The edges of the orifice develop into the *labia vulvæ*. The sex-thickenings do not become *labia vulvæ*, but come to lie in front of the clitoris and completely alter in appearance.

Studies on the Islands of Langerhans.*—K. Helly has made some investigations on the development and structure of these bodies, and concludes that they are present in all the vertebrate groups. They are organs *sui generis*, and as such fundamentally different in histological structure from the true pancreas. In development they arise from an epithelium which is not specifically differentiated as pancreas. No transitions between the two types occur at any period of their development, nor in the mature condition. Consequently, the view that they represent a kind of reserve material for the regeneration of the pancreas-cells cannot be held. It will be observed that these views are, on the one hand, markedly oppossed to those of Dale, while, on the other, they confirm the work of Diamare, Rennie, and others.

Club Cells in Epiderm of Fishes.†—M. Oxner has investigated the form, distribution, origin, and function of the peculiar club cells occurring in the epiderm of Cyclostomes and bony fishes. Within the Teleostei they are found in Physostomi (except Salmonidæ); they may be present or absent in very nearly-related families. It is not certain whether the formations occurring in Gadidæ and a few marine Acanthopterygii are to be regarded as true club-cells. In the genera in which they are present, they occur in the whole covering layer, with the limitation that they are always absent on the barbules and, with few exceptions, on the skin of the lips. Where they occur on the lips, they extend also to the epithelium of the tongue, of the mucous membrane and even of the pharynx of very young individuals. The distribution is not at all regular. They are most numerous on the head and neck region, and fewest on the pectoral and caudal fins. They are special unicellular gland-cells of protective function, they are able to form a kind of scurf over a wound, in eels they act as excretory glands, and they appear to have other functions as well.

b. Histology.

Neurological Studies.—Kurt Goldstein ‡ gives an account of the structure of the brain of Teleostean fishes, especially of the cerebral hemispheres and thalamencephalon.

Kurt Berliner § discusses the minute structure and the development of the cerebellum in various Vertebrates.

Structure of Amphibian Red Blood Corpuscles.‖—Fr. Weidenreich has studied the erythrocytes of the salamander and the frog. There is a distinct cellular membrane, but no demonstrable plasmic structure. The erythrocytes of amphibians differ from those of mammals in form and

* Arch. Mikr. Anat., lxvii. (1905) pp. 124–41 (1 pl.).
† Jena Zeitschr., xxxiii. (1905) pp. 589–646 (5 pls. and 1 fig.).
‡ Arch. Mikr. Anat., lxvi. (1905) pp. 185–219 (5 pls. and 28 figs.).
§ Tom. cit., pp. 220–69 (1 pl.).
‖ Tom. cit., pp. 270–98 (1 pl. and 2 figs.).

nucleus, but not otherwise. The form is conditioned by a marginal fold of the membrane, which is fixed by acid re-agents, whereas in very weak salt solution it is not fixed, and allows the disk to swell up into a sphere.

Enamel Prisms.*—Ernst Smreher has investigated the enamel prisms and the cementing substance of the enamel in human teeth. The enamel fibres are not as a rule prismatic hexagonal structures, but pillars of irregular form. The author explains how the form arises in the course of development.

Amitosis and Multinucleate Cells in Epithelium.†—M. Pacaut has found, especially in Rodents, the frequent occurrence of multinucleate cells in many-layered epithelium, e.g. of the œsophagus. The nuclei (2–4) usually remain apposed; they are formed by amitotic division, which is in most cases entirely normal.

Odontoclasts.‡—Coyne and Cavahé describe giant multinucleate phagocytic cells which help in the destruction of teeth. On the decaying surface of a tooth affected by caries, the fragments of enamel and ivory are seen to be surrounded by a finely granular clear envelope composed of these odontoclasts. Outside these there is a cellular zone of uninucleate, small, embryonic cells, which give rise to the odontoclasts. A microbic infection may be the "primum movens," but the actual destruction and absorption are due to the odontoclasts.

c. General.

Pœcilogony.§—A. Giard has collected and discussed instances of what he calls pœcilogony, that is, the occurrence in identical or nearly-related species of quite distinct modes of development, which are usually correlated with different conditions of life.

Cranial Nerves in Petromyzon.‖—J. B. Johnston has investigated the components of these nerves in the *Ammocœtes* of *P. dorsatus*. In the arrangement of the cranial nerve-components *Petromyzon* agrees in general with fishes, but shows some marked primitive characters. One or two of the special features demonstrated may be quoted. The profundus nerve retains its independence, but has added to it the equivalent of the rami ophthalmici superficiales trigemini and facialis of fishes. The visceral sensory component is very small in the facialis, but large in the glossopharyngeus and vagus. A sympathetic trunk and ganglia are present in the head.

Head-Ganglia and Sensory Line in Selachia.¶—W. Klinkhardt has studied the development of these in *Spinax niger*. He describes the ectoderm folds, and the origin therefrom of the sensory lines of

* Arch. Mikr. Anat., lxvi. (1905) pp. 312–31 (3 pls.).
† Verh. Anat. Ges., xix. Vers. See also Anat. Anzeig., xxvii. (1905) Erg. Heft, pp. 144–5.
‡ Loc. cit. See also Anat. Anzeig., xxvii. (1905) Erg. heft, p. 205.
§ Bull. Scient., xxxix. (1905) pp. 153–87. See also Zool. Zentralbl., xii. (1905) p. 773.
‖ Morphol. Jahrb., xxxiv. (1905) pp, 149–203 (1 pl. and 18 figs.).
¶ Jena Zeitschr., xxxiii. (1905) pp. 423–86 (3 pls. and 6 figs.).

the head, the ganglia and their relation to the ectoderm, and the histogenesis of the nerves. He has also some notes on the sensory lines in *Torpedo*. These arise as straight parallel-walled tubes, upon which lateral swellings develop on one side. These later reach the surface as open lateral tubules. Nerve-bulbs are situated opposite the points of origin of these side tubules. They are without doubt sensory structures, which in the course of phylogeny have arisen from corresponding structures situated on the surface.

Hardening of Teeth Enamel in Man.*—V. v. Ebner has studied the changes in enamel during hardening. As a rule, hardening takes place slowly, and is effected by a fluid stream (*Säftestrom*) of dentine into the inter-prismatic cement substance. The typical Retzius lines —contour lines—occurring in persistent teeth, as also the contour bands in milk-teeth, are due to a stoppage in the development of the enamel at an early stage of its growth. The formation of the enamel prisms stands in a much closer relation to the vital activity of the enamel cells than the formation (in many respects similar) of the prism layer of the mussel shell to the epithelial cells of the mantle edge. The typical arrangement and direction of the prisms are due to an inherited self-differentiation of the enamel cells; on the other hand, the form of the prisms seen in cross section admits of a mechanical explanation.

Red Blood Corpuscles of Amphibia.—F. Meves † gives an account of various alterations of form undergone by the red blood cells of frog and salamander when exposed to ammonia fumes and solutions.

J. Dogiel,‡ also, shows that under the influence of various physical and chemical agents, the form and composition of the red blood corpuscle may vary. Some indication also of the possibility of artificial initiation of mitosis of these and other tissue-elements has been found.

The Hæmocœle Theory.§—F. Vejdovský has investigated the relations of the vascular system in the Enchytræidæ, and in the light of the facts elucidated discusses the hæmocœle theory. To the question as to whether the hæmocœle is a remnant of the original blastocœle, or is an extra-intestinal mesoblastic schizocœle, he gives the following answer. The vascular system cannot be traced to the blastocœle; its most primitive constituent part, viz. the gut sinus with its outer cellular boundary, is an integral part of the endoderm. Neither can it be explained as schizocœle (in Huxley's sense), because it does not arise in the mesoblast; the mesodermal muscular layers represent a secondary envelope upon an endodermal structure. It is, in fact, a cavity *sui generis*, only fittingly distinguished as hæmocœle, which, nevertheless, is no new formation, since its original constituents—the blood-fluid and the enclosing vasothelium—arise from the endoderm.

Life-History of Blennius pholis.‖—W. C. McIntosh describes the egg, which possesses a disk for adhesion, and gives particulars of growth

* Arch. Mikr. Anat., lxvii. (1905) pp. 18–81 (4 pls.).
† Anat. Anzeig., xxvii. (1905) pp. 177–86 (17 figs.).
‡ Zeitschr. wiss. Zool., lxxxii. (1905) pp. 171–81 (1 pl.).
§ Tom. cit., pp. 80–170 (5 pls.).
‖ Op. cit., lxxxvi. (1905) pp. 368–78 (1 pl.).

and colour-changes from about 19 mm. onward to 85 mm. examples. The intervening larval and post-larval stages have not been observed. This blenny appears to be particularly hardy, and a striking instance of one (given up for dead after a railway journey and a night in-doors in a close vessel) is quoted. It was placed in seaweed in a dry vessel, and the following day, on showing signs of life, was put in sea-water. It revived, and lived until killed a month later. It appears also to be able to live in fresh-water for long periods without inconvenience.

Eyes of Periophthalmus and Boleophthalmus.*—W. Volz gives an account of the structure and special physiology of the eyes of these fishes. There is an active adaptation to sight at a distance, which is effected by the approximation of the lens to the retina. In repose, the lens lies near the cornea. By contraction of the cross-striped muscles around the sclerotic cartilage it is pushed backward, and thus approaches the retina, to which it may lie so near as to practically obliterate the posterior eye-chamber. This accommodation is effected when the fishes are on land.

Pectoral Girdle in Fishes.†—B. Haller discusses this subject with special reference to the Teleostei. Regarding the scapula in *Salmo*, he is of opinion that this was not originally a component of the primary shoulder girdle. It very probably corresponds to a basal. To this basal is joined secondarily the radii, which, well developed in *Acipenser*, less so in *Amia*, fall completely away in Teleostei. In *Acipenser*, *Polyodon*, and *Amia*, the scapula is joined as a cartilaginous piece to the primitive shoulder girdle. The large scapular opening in *Acipenser*, and the smaller one in the same place in *Amia*, are not comparable with one of the foramina on the shoulder girdle in Selachii. The latter are related rather to those on the coracoid in Teleostei.

Function of Parathyroids.‡— F. Pineles has something to say on this subject. He investigated these bodies in the cat, rabbit, and ape. In the cat he found that they are essential to life. Their removal causes fatal tetanus; frequently phenomena of paralysis are also induced. Even large portions of thyroid cannot replace them. The ape also exhibited symptoms of tetanus, but a more chronic course of the disease was manifested, possibly due, it is suggested, to the presence of similar organs situated elsewhere in the body. Results in the case of the rabbit were uncertain.

Secretion of the Preen Gland.§—Margarete Stern has studied the glandula uropygii of birds. It resembles the sebaceous glands of mammals in structure, function, and development. There is a true secretory process, by which a characteristic product is formed out of fat. The peripheral cells are always being formed anew and the central cells are always degenerating, but the breakdown of the cells occurs after the secretion has been formed in them. Rohmann's analysis shows that the secretion consists of a minute quantity of fat (triglyceride of fatty acids),

* Zool. Jahrb. Abt. Anat., xxii. (1905) pp. 331–46 (1 pl.).
† Arch. Mikr. Anat., lxvii. (1905) pp. 231–68 (2 pls. and 6 figs.).
‡ SB. Akad. Wiss. Wien, cxiii. (1904) pp. 199–238.
§ Arch. Micr. Anat., lxvi. (1905) pp. 299–311 (1 pl.).

but mainly of the fatty acid (palmitin and stearin) "ester" of octadecyl alcohol, and another substance soluble in chloroform.

Migrations.*—T. Southwell points out in an interesting paper that the periodic movements which we are accustomed to call "migrations" are of widespread occurrence, and by no means confined to birds. He gives the following instances: the mackerel and the herring (very local movements in both cases), the lemmings, the field mice, the eared seals, and most cetaceans, e.g. the bottle-nose whale (*Hyperoodon*), the white-beaked dolphin, and the right whale.

Nidamental Organ of Dogfish.†—V. Widakowich describes the structure and function of the nidamental organ in *Scyllium canicula*. The structures implicated are the modified internal wall of the oviduct, and four kinds of glands. There is a white albumen gland, a reddish shell-gland, between these a large tubular mucus gland, and finally numerous small mucus glands in the wall of the oviduct. The complex tubular structure of the glands is described in detail. The shell is built up of many thin lamellæ, which seem to arise from the coalescence of cylindrical threads.

Metamerism in Integumentary Structures.‡—Otto Grosser discusses alleged cases of metameric arrangement in integumentary structures, e.g. scales in reptiles and stripes in mammals. His results are somewhat negative. In none of the instances is the metamerism really demonstrable, unless perhaps Mayer's case of segmentally arranged transitory scales in young embryos of *Scyllium* and *Pristiurus*. The apparent segmental arrangement is probably secondary, and due to mechanical factors.

Dorsal Gland of Dendrohyrax.§—Th. Mollison gives an account of this gland, which secretes a scent substance having a musky smell. The smell is not sufficiently strong to be effective in repelling enemies; its function is more likely to attract individuals of the same species. Its position is marked by a brighter spot amongst the hair. The hairs upon this spot do not arise over the gland, and the distal portions only are brightly coloured. The gland is probably functional only at certain times, e.g., the pairing season, since even in the adult its duct is closed by an epithelial plug.

Morphology of Reptile Brain.‖—L. Unger gives an account of the cerebrum in *Gecko*. One or two of his special points may be quoted. He has demonstrated the presence of a non-medullate *commissura septi*, forming a continuation of another non-medullate commissure which radiates into the hemispheres. There is a bundle of fibres of the *Fasciculus septa-parolfactorius* uniting the septum with the area parolfactoria.

Secretion in Urinary Ducts in Mammals.¶—O. V. C. E. Petersen describes secreting gland-cells in the ureter, pelvis renis, and vesica of

* Trans. Norfolk and Norwich Nat. Soc., viii. part 1 (1905) pp. 15–21.
† Zeitschr. wiss. Zool., lxxx. (1906) pp. 1–21 (2 pls.).
‡ Tom. cit., pp. 56–179 (8 figs.).
§ Morphol. Jahrb., xxxiv. (1905), pp. 240–5 (1 pl.).
‖ SB. Acad. Wiss. Wien, cxiii. (1904) pp. 141–60 (2 pls.).
¶ Anat. Anzeig., xxvii. (1905) pp. 187–99 (4 pls.).

various mammals. He also found glycogen in the cells of the various regions of the urinary duct system in the horse and ass. In other animals the ureter and vesica epithelial-cells coloured brown with potassium iodide; only in a few isolated cells was this brown colour localised in granular masses.

Action of Radium Rays on Skin.*—A. Exner has experimented with these upon the tails of mice. The deflectible β-rays and the non-deflectible γ-rays possess great power of penetration; that of the α-rays is only very trifling. Notwithstanding the fact that most of the rays are deflected by means of the magnet, their effects upon the skin are not different from those of the non-deflectible component.

Fauna of the Gulf of Trieste.†—E. Graeffe deals with the Chætognatha, Gephyrea, Annelida, and Enteropneusta. He gives particulars regarding the place of occurrence, mode of life, time of appearance and of spawning, in various species.

Tunicata.

The Visual Organ of Salpa.‡—W. Redikorzew finds that the solitary and chain forms of the same species have eyes which are structurally different. All solitary forms have the same type of eye; the chain forms, on the contrary, show great diversity in this organ. Besides the chief eyes, supplementary visual elements are present, which, however, are unequally developed. The author describes the eyes in histological detail. His observations have suggested the view that primitive Tunicates possessed visual organs in a paired series extending caudalwards from the head end, and that each pair probably corresponded to a somite.

INVERTEBRATA.

Mollusca.

α. Cephalopoda.

Photogenic Organs in the Eye of a Cuttlefish.§—L. Joubin describes in *Leachia cyclura* six luminous organs, one on the dorsal surface and five on the posterior margin of the eye. Each is surrounded by a connective-tissue envelope, and contains large photogenic cells and a lens. The lens arises from epithelial and deeper cells, and in most of the organs is surrounded by a cartilaginous ring. The organs differ from one another in detail, and may have different luminous effects, possibly resulting in a specific "recognition-mark."

β. Gastropoda.

Salivary Glands of Snail.‖—M. Pacaut and P. Vigier describe five chief phases in the salivary cells of *Helix pomatia*—punctate, alveolar,

* SB. Acad. Wiss. Wien, cxiii. (1904) pp. 185–8.
† Arbeit. Zool. Inst. Univ. Wien, xv. (1905) pp. 317–32.
‡ Morphol. Jahrb., xxxiv. (1905) pp. 204–39 (1 pl.).
§ Bull. Mus. Oceanogr. Monaco, No. 33 (1905) p. 13. See also Zool. Zentralbl., xii. (1905) pp. 478–9.
‖ Ver. Anat. Ges., xix. Vers. See also Anat. Anzeig., xxvii. (1905) Erg. heft, pp. 151–3.

granular, cystic, and mucous. But besides this series ending in mucus-formation, there is another series ending in ferment-formation. Mucocytes have to be distinguished from zymocytes. Some of the cells, especially those of punctate and alveolar aspect, show remarkable chromophilous formations. Three ergastoplasmic differentiations are described. The authors also describe the various stages in the maturation and dissolution of the grains of zymogen.

Spinning Gastropods.*—L. Lindinger has an interesting note on Gastropods which form firm threads of mucus. He has observed the process in *Agriolimax agrestis*, *A. lævis*, *Limax arborum*, *L. variegatus*, and in various species of water-snail (*Ancylus*, *Bythinia*, *Physa*, *Planorbis*). Some of the terrestrial forms often let themselves down from a leaf by a thread ; some of the aquatic forms use the thread both in ascent and descent.

Embryology of Physa fontinalis L.†—A. Wierzejski gives an exhaustive account of the segmentation up to the 123-celled stage, including a consideration of the development of certain larval and adult organs. He summarises his results in thirty-five conclusions. He has found no evidence of an early localisation (in Conklin's sense) of organ-forming substances in single blastomeres. From cells of the same origin diverse organs may arise, e.g. from the descendants of an early blastomere (*4d*) were traced the larval kidneys, muscles, and connective tissue, with probably also the heart and sex-glands. There is, in fact, no reliable evidence for a rigid homologising of the blastomeres and germinal layers.

Heart and Arteries in Diotocardia.‡—J. Spillman has investigated the structure of the central vascular system in the Diotocardia, including the histology of the heart muscle, the arteries, and the lacunæ. The Diotocardia show in the anatomical structure of their hearts significant differences, such that, from this point of view, their separation into Rhipidoglossæ and Docoglossæ seems justified. The Rhipidoglossæ have a ventricle which is pierced by the hind gut. They possess two auricles which in some cases close towards the ventricle by lamellar valves. The ventricle in the Docoglossæ is not pierced by the gut. There is only one functional auricle—the left—which possesses a tube-like valve. Whilst the ventricle in Rhipidoglossæ passes directly into the aorta, in the Docoglossæ there is a bulbus arteriosus, which always lies outside the pericardium. In the Rhipidoglossæ there are pericardial glands with secretory function, in whose cells are small rod-shaped crystals ; similar crystals occur in the epithelial cells of the left kidney.

Prototracheata.

Monograph of Onychophora.§—E. L. Bouvier has published the first part of a monograph on Onychophora, which he dedicates to Prof.

* Zool. Anzeig., xxix. (1905) pp. 605–10.
† Zeitschr. wiss. Zool., lxxxiii. (1905) pp. 502–706 (10 pls. and 9 figs.).
‡ Jena Zeitschr., xxxiii. (1905) pp. 537–88 (3 pls. and 2 figs.).
§ Ann. Sci. Nat. Zool., ii. (1905) pp. 1–240 (96 figs.).

E. Ray Lankester, and heads with the appropriate quotation from Gaudry "Vieux habitants de la terre, apprenez-nous d'où vous êtes venus."

After an historical introduction, the author gives a general account of the structure, development, and habits of the Onychophora.

He recognises two families: (1) Peripatidæ R. Evans, including *Peripatus* Pocock, *Eoperipatus* R. Evans; (2) Peripatopsidæ n. f., including *Peripatoides* Pocock, *Ooperipatus* Dendy, *Opisthopatus* Purcell, *Paraperipatus* Willey, and *Peripatopsis* Pocock. Then follows the systematic description of species, which takes account, so far, of 19 species of *Peripatus*.

Arthropoda.

a. Insecta.

Ocelli of Ephemerids.*—W. Seiler finds that the ocelli of Ephemeridæ are epithelial, anaxonial structures, surrounded by a pigment cup composed of a single layer of epithelium, with a lens composed of distinct cells, and of hypodermal origin. Two types are distinguished which differ in the structure of the lens and in the behaviour of the cornea-forming cells.

Germ-Cells of Aphides.†—N. M. Stevens finds in *Aphis rosæ* and *A. œnotheræ* that the ova have five pairs of chromosomes, which exhibit no reduction in the parthenogenetic eggs. In all cases only one polar body is liberated, and it has no role in development. In the resting eggs and in the spermatogenesis there is a reducing process. The chromosomes conjugate in pairs and are then divided by two longitudinal divisions. There is no accessory chromosome, so McClung's theory of sex-determination is rejected. The author believes that the determination is due to external influences operating on the egg.

Heart of Mallophaga.‡—L. Fulmek has studied *Lipeurus baculus*, *Goniocotes compar*, *Trichodectes subrostratus*, *Gyropus gracilis*, and a species of *Nirmus*, with especial reference to the heart. He concludes that the dorsal blood-vessel of *Mallophaga* has only a few pairs of ostia (2–3), which are restricted to the hindmost region—the heart, in the strict sense. The heart lies in the 7th abdominal segment, or on the boundary of the 7th and 8th segments. It is continued forwards in an aorta which is independently contractile in its posterior portion.

Malpighian Tubules.§—A. Veneziani describes the minute structure of the Malpighian tubules in a large series of insects, discussing also their colouring matter, contents, number, polymorphism, and precise mode of excretion. There is a constant relation between the surface area of the tubes and the mass of the body; the number is not indefinite, but reducible to three groups of 2, 4, and 6, which may be simple or much branched; the pigment is a urochrome (entomurochrome): the substances excreted are uric acid, urates, phosphates, oxalate of lime, to which may be added carbonate of lime or soda, leucin (in Dytiscidæ),

* Zool. Jahrb., xxii. (1905) pp. 1–40 (2 pls. and 1 fig.).
† Journ. Expér. Zool., ii. (1905) pp. 313–33 (4 pls.). See also Zool. Zentralbl., xii. (1905) pp. 809–10.
‡ Zool. Anzeig., xxix. (1905) pp. 619–21 (1 fig.).
§ Redia, ii. (1905) pp. 177–230 (3 pls.).

and salts of lime with an undetermined base (in Phasmids). There is sometimes distinct polymorphism. The intra-cellular mechanism of excretion is complex; the transport of excreted substances into the gut is partly due to a pressure from newly-formed material and partly to muscular action. There are accessory functions of eliminating colouring matter, and sometimes of forming calcareous materials. The gut, the integument, and the adipose tissue may also aid in excretion.

Behaviour of Nucleolus in Spermatogenesis of Cockroach.*—J. E. S. Moore and L. E. Robinson find in the nucleus of the spermatogonia of *Periplaneta americana*, a chromatin-nucleolus, which is expelled in the formation of the spindle, and degenerates in the plasma. Another nucleolus arises *de novo* in the daughter-cell.

Before the maturation divisions there is a longitudinally split chromosome-like body present, comparable to the accessory chromosome. It also degenerates in the plasma.

In the spermatid, finally, there is again a nucleolus, differentiated from the chromatin of the nuclear framework. It divides, and one half is extruded into the plasma, while the other disappears in the nucleus.

Ovaries of Mallophaga and Pediculidæ.†—J. Gross has examined these and finds a quite striking agreement in the structure of the egg-tubes and eggs of the two groups. This extends to details. In both groups the ovaries are fascicular, with at most five egg-tubes. They are always polytrophic, without nutritive chambers. There is in both a small number of nutritive cells—five appears to be the ruling number; and, further, the egg formation appears to go on in the same way. There is, in fact, a whole series of striking resemblances, such that, as far as the female sex-organs go, the two groups might be united in one order. The Pediculidæ do not show such agreements with the Hemiptera.

Sense Organs of Insects.‡—E. Röhler reviews the known facts regarding these in insects generally, and gives a detailed account of them in *Tryxalis nasuta*, and of the antennary organs in *Musca vomitoria*. In the former there are three types upon the antennæ. There are sensory cones in pits (sensilla cœloconica of Schenk), which are markedly different as regards numbers in the two sexes, and which probably have a smelling function. The second type consists of surface cones (sensilla basiconica of Schenk), which are organs of touch; and, lastly, there are bristles which, if sensory, are but relatively coarse touch organs, and which do not regulate the movements of the antennæ. Of the groups of hair around the mouth some serve for the mechanical examination of the food, while others subserve the function of taste.

The Oil of Indian Mites.§—E. G. Hill makes a note on the chemical composition of the oil which is extracted from a red mite, *Bucella carniola* (*Trombidium grandissimum*), a creature about half-an-inch

* Quart. Journ. Micr. Sci., xlviii. (1905) pp. 571–83 (2 pls.).
† Zool. Jahrb. Abt. Anat., xxii. (1905) pp. 347–86 (2 pls. and 2 figs.).
‡ Tom. cit., pp. 225–88 (2 pls. and 1 fig.).
§ Journ. and Proc. Asiatic Soc. Bengal (1904) i., pp. 74–80.

long, known as the "rains insect." It is only to be found for a few weeks in the year at the beginning of the rainy season. On pressure it exudes a deep red oil, which is used medically externally as a counter-irritant. It appears to have no such properties, and its supposed efficacy as a medicine is probably purely imaginary, and due to its colour. The oil is principally composed of myristodiolein. There is possibly also present an alcohol of high molecular weight belonging to the fatty series of carbon compounds.

γ. Myriopoda.

Spermatogenesis of Scolopendra heros.*—M. W. Blackman gives a very full account of the spermatogonia, the spermatocytes and their maturation divisions, and the metamorphosis of the spermatids. Nuclear and cytoplasmic structures are discussed in detail.

Spermatogenesis in Myriopoda.†—M. W. Blackman gives an account of the karyosphere and nucleolus in the spermatocytes of *Scolopendra subspinipes*. In these there is a large plasmosoma, or true nucleolus, during stages of mitotic inactivity, whose presence seems to necessitate a specific variation in the behaviour of the chromatin. Notwithstanding this variation, the process is essentially similar to that previously described in *S. heros*.

δ. Arachnida.

Ovarian Eggs of Spiders.‡—E. Strand gives a series of notes with reference to various species of spiders, upon the growth of the egg and the behaviour of the nuclei. The paper is preliminary to a more detailed communication.

Classification of Spiders.§—Fr. Dahl discusses the systematic relationships of the sub-orders of Araneæ, and gives a useful diagnostic key, showing the salient features distinctive of the sub-orders Verticulatæ, Tetrapneumones, Oligotrichiæ, Chalinuræ, Stichotrichiæ, Polytrichiæ, Tubitelæ, Laterigradæ, Saltigradæ, and Apneumones.

Spinning Mite on Conifers.‖—A. Jacobi discusses the damage done to conifers by *Tetranychus ununguis* sp. n., a new spinning mite marked by the presence of a true claw on the last joint of the foot. It is kept down by small black spiders and numerous Coccinellidæ, of the genus *Exochomus*, and may be successfully dealt with by using a dilute soap solution.

South American Pseudoscorpions.¶—E. Ellingsen describes from the collection of F. Silvestri examples of the genera *Chelifer*, *Ideobisium*, *Chthonius*. Several new species are included in the survey.

* Bull. Mus. Compar. Zool., xlviii. (1905) pp. 1–138 (9 pls.).
† Proc. Amer. Acad. Arts and Sci. xli. (1905) pp. 331–44 (1 pl.).
‡ Jena Zeitschr. xxxiii. (1905) pp. 487–96 (1 pl.).
§ Zool. Anzeig., xxix. (1905) pp. 614–19.
‖ Naturwiss. Zeitschr. Land. Forstw., iii. (1905) pp. 239–47 (2 figs.). See also Zool. Zentralbl., xii. (1905) pp. 573–4.
¶ Zool. Anzeig., xxix. (1905) pp. 323–8.

ε. Crustacea.

Life-History of Cladocera.* — Robert Gurney gives a general account of the reproduction and life-history of Cladocera. He discusses the occurrence of the sexual periods in different years, and is disinclined to agree with Weismann that the appearance of the sexual individuals is unaffected by external conditions. He believes that further experiments will show a direct connection of the sexual cycle with the season, determined probably by the average temperature, and that the sexual individuals of the second (autumn) cycle are not wholly, or even largely, derived from the resting eggs of the previous cycle, but are their descendants by agamic reproduction.

Respiration in Sand-Burrowing Crabs.† — W. Garstang discusses the various ways in which burrowing crabs draw up a sufficient supply of water free from particles of sand and mud. In the common shore-crab and in Portunidæ the claws, together with the marginal spines of the shell, form a sieve. In *Calappa* and others without filtering spines, there are crest-like expansions, divided into spines and notches on the upper edge of the claws themselves. In *Corystes* the water is sucked in in front along a temporary tube formed by the juxtaposition of the long antennæ, which bear a double row of curved hairs. When *Atelecyclus* lies in the surface layer, it uses its antennæ as a funnel; when it goes deeper, it forms a reservoir beneath the body by folding in its claws and other legs. The water percolates between the chelipeds and the carapace, and through the filters formed by the interlocking rows of hairs on the legs.

Decapods collected by the 'Princess Alice.'‡ — E. L. Bouvier calls attention to some of the interesting forms collected in 1905 by the Prince of Monaco. The list includes the rare Peneid *Hepomadus tener* Smith; a Pagurid, with aciculate ophthalmic scales, *Anapagurus lævis* var. *longispina* Edw. et Bouv.; an Eryonid, *Polychetes eryoniformis* sp. n.; a very remarkable abyssal form, *Eryoneicus alberti* sp. n.; a beautiful red Peneid, *Gennadas elegans* Smith; and another abyssal form, *Glaucothoe peroni* Edw.

Reproduction in Copepods.§—E. Wolf has made a very exhaustive study of the biology of reproduction in the Copepods of Wurtemberg. The locality is rich in Cyclopidæ and Harpactidæ, and, on the contrary, poor in Centropagidæ. All the native species show regular times of reproduction—i.e. all the members of a species reproduce and die about the same time, making place for the new generation, although special conditions, such as drought, want of food, etc., may disturb these relations. Nearly related species in the same habitat show somewhat similar periods of reproduction, while, on the other hand, the same species in different habitats may in the same year give rise to a different number of generations. A single species may exhibit varieties with entirely different reproductive modes. All Copepods in unfavourable seasons are

* Trans. Norfolk and Norwich Nat. Soc., viii. part 1 (1905) pp. 44–58 (4 figs and 2 tables.).
† Tom. cit., pp. 22–4.
‡ Comptes Rendus, cxli. (1905) pp. 644–7.
§ Zool. Jahrb. Abt. Syst., xxii. (1905) pp. 101–280 (2 pls., 1 fig.).

able either to last throughout the winter, or to produce resting eggs for the same purpose. Various other points of interest are contained in the memoir.

Isopods of North-west Coast of North America.* — Harriet Richardson reports on the Isopods collected by the Harriman Expedition. Five new forms are described: *Sphæroma pentodon*, *Synidotea ritteri*, *Janiropsis kincaidi*, *J. californica*, and *Trichoniscus papillicornis*. A little-known species, *Idotea gracillima* (Dana) is figured for the first time, and described more fully than heretofore; and *Asellus tomalensis* Harford, is re-described and figured.

Alaska Decapods.† — Mary J. Rathbun gives an account of the Decapod Crustaceans of the North-west coast of North America collected by the Harriman Expedition. The predominant types are Pandalid, Hippolytid, and Crangonid shrimps, Paguridæ, Maiidæ, and Lithodidæ. Arctic species often continue southwards through Bering Strait along the west coast of Bering Sea to Okhotsk Sea and the Kurile Islands. Some reach Puget Sound. The winter line of floating ice in Bering Sea determines the northern limit of many species. While many species range continuously from this line southwards to California, others indicate a division of that stretch of coast line into several faunas. A few Japanese species were found. The total number of forms dealt with in this report is enormous. One new species, a *Betæus*, is notable as the first Alpheid reported from as high a latitude as Sitka. A remarkable case of dimorphism is described in *Processa canaliculata* Leach (= *Nika edulis* Risso).

Occurrence of Apus in Baluchistan.‡ — E. Vredenburg gives a brief but interesting note regarding the presence of the genus *Apus* (species undetermined) in very large numbers in what appeared to be a transitory pool of small dimensions at Thalonk. This is the first record for the genus within the limits of the Indian Empire.

Annulata.

Natural History of Tomopteridæ.§ — M. Schwartz discusses the structure of the known species of *Tomopteris* in relation to their predominant habits. He divides the group into those with tail appendage, and those without. Of the former there are two groups, viz. those having a long appendage clearly delimited from the rest of the body, and those having a shorter tail on which are rudimentary parapodia of unequal significance. The long-tailed forms are of floating habit, the others swim actively. Swimming is effected by the beating of the parapodia, the right and left of each pair acting alternately, not simultaneously. The result is a wave-like motion along the body. Steering and balancing are effected by means of the cirri. Tomopteridæ are probably detritus and vegetable feeders. They are kept alive with difficulty in tanks.

* Harriman Alaska Expedition, x. (1904) pp. 213–30 (11 figs.).
† Tom. cit., pp. 1–190 (10 pls. and 95 figs.).
‡ Journ. and Proc. Asiatic Soc. of Bengal (1905) i. pp. 33–4.
§ Jena Zeitschr., xxxiii. (1905) pp. 497–536 (1 pl. and 9 figs.).

Determination of Sex in Daphnids.*—Alexander Issakowitsch combats the view that the appearance of amphimixis in the course of the parthenogenetic generations is only indirectly correlated with external conditions. He has made experiments with *Simocephalus vetulus* O. F. Müller, and these lead him to the conclusion that nutrition and temperature (by affecting nutrition) are the determining factors in the continuance or interruption of the parthenogenesis. There is no cyclic sequence of events in Weismann's sense.

Alaskan Amphipods.†—S. J. Holmes reports on 22 species of Amphipods collected by the Harriman Alaska Expedition. The following are new:—*Tryphosa nugax*, *Stenothoe alaskensis*, *Gammaropsis tenuicornis*, *Caprella alaskensis*, *C. scabra*, *C. kincaidi*.

Pycnogonids of the West Coast of North America.‡—Leon J. Cole, in reporting on the Harriman and other collections, gives a useful discussion of the confusing terminology of the external features. Thirteen species are dealt with, of which the following are new:—*Lecythorhynchus marginatus*, *Tanystylum intermedium*, 6 species, *Clotenia occidentalis*, *Halosoma viridintestinalis* g. et sp. n., *Anoplodactylus erectus*.

Regeneration in Polychæts.§—J. Nusbaum gives a detailed account of the regenerative processes in *Amphiglene mediterranea* Leydig and *Nerine cirratulus* Delle Ch. He deals especially with the closure of the wound at the posterior or anterior end of the body, the regeneration of the posterior or anterior gut, the regeneration of the cerebral ganglion, of the œsophageal commissure, of the ventral cord, of the longitudinal and circular musculature of the blood system, and of the parapodia. He shows that Weismann's adaptive theory of regeneration is so far useful, but that it does not suffice to cover the facts.

Artificial Parthenogenesis in an Annelid.‖—G. Bullot has reared free-swimming larvæ of *Ophelia* from artificially parthenogenetic ova. The mixture used was 2 c.cm. $2\frac{1}{2}$ *n* KCl + 88 c.cm. sea-water. After two hours the first cleavage was completed; after five hours there were blastulæ, which soon began to swim a little. From 20–60 p.c. of the artificially parthenogenetic ova became larvæ, but none lived longer than two days. Contrary to Lillie's results, the segmentation appeared to be quite regular.

Regeneration in Lumbriculus variegatus.¶—F. von Wagner finds that the restoration of the head end depends on the proliferating and formative power of the epidermis, aided by the epithelium of the gut, and by the activity of special elements, the "neoblasts." The repair of the alimentary tract precedes that of the nervous system.

The proliferations of the epidermis show three stages: first there

* Biol. Centralbl., xxv. (1905) pp. 529–36.
† Harriman Alaska Expedition, x. (1904) pp. 233–46 (11 figs.).
‡ Tom. cit., pp. 249–98 (16 pls.).
§ Zeitschr. wiss. Zool., lxxix. (1905) pp. 222–307 (4 pls. and 1 fig.).
‖ Arch. Entw. Mech., xviii. (1904) pp. 116–70 (13 figs.). See also Zool. Zentralbl., xii. (1905) pp. 435–6.
¶ Zool. Jahrb, xxii. (1905) pp. 41–156 (5 pls.).

is simple cell multiplication; then there appear large sub-epithelial dermatoblasts; finally these break up into ordinary reparative cells.

The new nerve-cord is wholly ectodermic, and the old cord does not help in its making. The metamerism of the repaired portion is at first entirely internal.

In the reparatory proliferations there is mitosis throughout, though there are a few direct divisions at the outset.

In general terms, it may be said that the regenerative process is much more plastic and less stereotyped than the normal ontogeny; but regeneration, like every other process, is under the sway of heredity and adaptation.

We have not been able to do more than select a few of the general conclusions of this interesting investigation.

Bythonomus lemani Grube.*—Emile Piguet has a brief note on the occurrence of this Oligochæte in Lake Geneva, and on the history of its discovery by Claparède and by Grube. He shows that *B. lemani* Grube is equivalent to *Claparedeilla integrisetosa* (= *C. meridionalis*) Vejdowsky.

Nematohelminthes.

Death from Infection with Ascaris.†—H. Ziemann reports a case of a negro boy in Kameroon who died with symptoms of peritonitis. The post-mortem examination showed an extraordinary abundance of *Ascaris lumbricoides* in the intestine. Four litre glasses were filled with them. Two were free in the peritoneal cavity, and there were two round holes in the wall of the intestine.

Rachis Nucleus in Ascaris.‡—Harry Marcus finds—what has escaped previous observers—that there is a very distinct nucleus in the rachis of *Ascaris megalocephala*. It is probable that the rachis should be regarded as a giant cell, possibly with more than one nucleus. In one ovarian tube of *A. megalocephala* two rachis-nuclei occurred. In *A. mystax* one rachis-nucleus was found.

Platyhelminthes.

Turbellaria Acoela.§—L. von Graff has prepared the systematic account of the Turbellaria Acoela for "Das Tierreich." He deals with 7 genera and 32 secure species. All are marine, littoral or pelagic. One form, *Haplodiscus incola* (Leiper), lives as a parasite in *Echinocardium cordatum*. There are the usual diagnostic tables and keys.

Origin of Species in Cestodes.‖—Guido Schneider discusses the question of the origin of species in the case of Cestodes, especially Ichthyotæniæ, and gives evidence of the divergence in the external

* Rév. Suisse Zool., xiii. (1905) pp. 617–19.

† Arch. Schiffs- und Tropen-Hygiene, ix. (1905) pp. 33–4. See also Zool. Zentralbl., xii. (1905) p. 634.

‡ Biol. Centralbl., xxv. (1905) pp. 479–82 (3 figs.).

§ Das Tierreich, 23 (1905) 35 pp. (8 figs.).

‖ Biol. Centralbl., xxv. (1905) pp. 349–52.

genitalia which renders cross-fertilisation between nearly related species difficult or impossible. He comes to the conclusion that structural variation and the isolation which parasitism implies, are not in themselves sufficient to account for the establishment of new species. There must also be reproductive isolation.

Dipylidium caninum in Man.*—F. Zschokke reports a case of a four-year old boy who was infected with this common tapeworm (better known as *Tænia cucumerina*) of cats and dogs. O. von Böllinger † reports four cases, two adult women, two children, of the same occurrence, which he thinks is commoner than is supposed. Altogether 41 cases have been put on record.

Origin of Gonoducts in Platodes.‡—A. Luther gives some notes on the question of the relation of the gonoducts to the excretory system. He is of opinion that the gonoducts in Turbellaria have arisen quite independently of the excretory canals, and that since the corresponding organs in Trematodes and Cestodes are undoubtedly derived from those of Turbellaria, this conclusion applies to all Platodes.

New Distomidæ from Chelonians.§—Georg Heymann describes from the small intestine of *Dermatemys marii* Gray, *Patagium brachydelphium* g. et sp. n., an immature species of *Telorchis*, and an undetermined immature Distomid. From the same region of *Kachuga tectum* Gray, are noted *Distomum* [illegible] sp. n., and an immature *Distomum*, whose species is undetermined.

New Distomidæ from Rana.‖—W. Klein gives an account of four new forms from *Rana hexadactyla*. The genera represented are *Pneumonoeces*, *Haematoloechus*, *Pleurogenes*, and *Ganeo*, g. n. Keys for the diagnoses of species of the genera *Pneumonoeces* and *Plurogenes* are included in the paper.

Incertæ Sedis.

Development of Pedicellina echinata.¶—J. Lebedinsky has followed the development of this Polyzoon. Some of his results may be briefly noted. In the first directive spindle there are eight chromosomes; several spermatozoa enter the egg, but only one survives; the segmentation is total and unequal; a bipolar blastula results; a gastrula is formed by invagination; there are two primary mesoblasts. The dorsal organ, or "head-ganglion," is formed by an invagination of ectoderm; its ciliated cavity communicates with the exterior; it gives three pairs of commissures. There is a true œsophageal nerve ring. The "cement gland" arises as an invagination of ectoderm, and is ultimately differentiated into "punktsubstanz" and ganglion-cells. The atrium arises as a ventral invagination; the vagina is formed as a

* Centralbl. Bakt. Parasit., xxxviii. (1905) p. 534.
† Deutsch. Arch. Klin. Med., lxxxiv. (1905) pp. 50–6. See also Zool. Zentralbl., [illegible] 77–8.
‡ [illegible], xxix. (1905) pp. 409–11.
§ [illegible] Abt. Syst., xxii. (1905) pp. 81–100 (1 pl. and 2 figs.).
‖ [illegible] 59–80 (1 pl.).
¶ [illegible]bl., xxv. (1905) pp. 536–48 (2 figs.).

median invagination of the floor of the atrium. When the blastopore closes, the endoderm forms a diverticulum, morphologically comparable to a rudimentary notochord. The mesenchyme arises from a bisymmetrical posterior thickening of ectoderm. The primary mesoblasts form two bands, which give rise to three pairs of somites—the anterior forming the embryonic excretory organs, the median and posterior represent the primordia of ovaries and testes respectively.

Structure of Cephalodiscus.*—A. Schepotieff upholds the position of McIntosh that *Cephalodiscus* and *Rhabdopleura* are nearly allied. The latter is the more primitive, since it has an open "branchial groove," while the former has two gill-clefts. With Ray Lankester the author agrees in maintaining that the Pterobranchia form a natural group. They lead on to Enteropneusts, and probably originated from a trochophore type.

Peculiar Variation of Terebratula transversa Sowerby.†—H. W. Shimmer describes a peculiar specimen, which differs from the type in its more elongate form, thicker valves, obscurity of plications, and less marked development of the mesial sinus in the brachial valve. It is also remarkable for its extremely rugose surface due to the great inequality in the development of growth lines, and also for the greatly abraded umbo of the pedicle valve.

Devonian Spirifers.‡—F. Chapman gives a note on the identity of *Spirifer lævicosta* McCoy, with *S. yassensis* de Koninck, together with a description of *S. howitti* sp. n., from Victoria.

Rotatoria.

Retro-Cerebral Organ in Rotifera.‖—P. de Beauchamp discusses the nature of this organ in Rotifers, which has usually been called the brain-sac by older students of this group. It is situated above and behind the true brain, and is more or less connected with it, but is not part of the brain itself. The author describes three types: The first type is that which is found in *Euchlanis dilatata*, where it is a very large sac, extending posteriorly over the mastax and anteriorly to the corona, and opens in two short papillæ on the head and within the pre-oral ciliary wreath. The wall of this organ is very thin, and contains a secretion which can be stained with neutral red in the living animal.

The second type is found in *Notommata aurita*, where the organ is a small sac closely adherent to the under part of the brain, of which it has hitherto been considered to form a part, sending a tubular prolongation upwards, which, after bifurcating, terminates in two openings on the top of the head on a level with the integument. Posteriorly the sac contains small opaque granules which have been erroneously described as calcareous masses.

* Bergens Mus. Aarb, No. 8 (1905) pp. 1–20 (2 pls.).
† Amer. Nat., xxxix. (1905) pp. 691–8 (5 figs.)
‡ Proc. Roy. Soc. Edinburgh, xxv. (1905) pp. 1092–1167.
§ Comptes Rendus, cxli. (1905) pp. 961–3.

The third type is that of *Copeus copeus* (*Ehrenbergi*) and *Eosphora aurita*, where the sac has two additional lobes, one on each side of the central organ.

The retro-cerebral organ, according to the author, is essentially glandular, connected with the dorsal side of the brain, bifurcated in front at least, opening outwards by two openings, and elaborating a secretion which is capable of being stained in the living animal with neutral red.

In *Notommata* and similar forms it seems, from its close connection with the brain and eye, to have adapted itself also to a sensory function, and to elaborate a new secretion in the form of minute opaque granules. In *Copeus* and *Eosphora* it has two additional lobes which may contain similar granules.

It will now be necessary to follow the ontogenetic and phylogenetic development of this organ, to elucidate its supposed functions, and to study the physical and chemical properties of its secretions.

Northern Marine Rotifers.*—In Part X. of a work called "Nordisches Plankton," on the floating marine fauna and flora of the Northern seas, R. Lauterborn has compiled a useful list of all the known Rotifers inhabiting the sea, altogether some 30 species and varieties, with figures of the marine *Synchæta*, *Anuræa*, and *Notholca*.

Conochiloids, New Genus of Rotifers.†—S. Hlava has transferred *Conochilus dossuaris* (Hudson) and *C. natans* (Seligo) to this new genus characterised mainly by the animals living singly, or very few together in a gelatinous envelope, and possessing two large dorsal antennæ. The author then describes the minute structure of *Conochiloides natans* in great detail, comparing at same time the different organs with those of other Rotifers which have been studied in the same way. No new features in the anatomy of Rotifers are brought out.

Rotifera in Iceland.‡—C. Wesenberg-Lund, in a study of the plankton of the two Icelandic lakes, Thingvallavatn and Myvatn, from samples collected for him at regular fortnightly intervals during a whole year, records the following 11 species of Rotifers: *Polyarthra platyptera*, *Synchæta neglecta* (should be *oblonga*), *Ploesoma lenticulare*, *Asplanchna priodonta*, *Anuræa aculeata*, *A. cochlearis*, *Notholca longispina*, *N. striata*, *Triarthra longispina*, *Brachionus pala*, *Conochilus unicornis*. The list of species of both the lakes is almost identical, although Thingvallavatn is situated in the south-western part of the island, is very deep and never freezes, whilst Myvatn is situated in the northern part of the island, is very shallow and is covered with ice from November to the end of May. The highest summer temperature of the water is 11° and 12° C. respectively.

Echinoderma.

Structure of Pentacrinus Decorus.§—A. Reichensperger has been fortunate enough to secure some good material from the "Blake" collection, and has discovered some new facts.

* Nordisches Plankton. X. Rotatorien, pp. 18–42.
† Zeitschr. wiss. Zool., xviii. (1905) pp. 282–326 (2 pls.).
‡ Proc. Roy. Soc. Victoria, xviii., n.s. (1905) pp. 16–19 (1 pl.).
§ Zeitschr. wiss. Zool. lxxx. (1905) pp. 22–55 (3 pls. and 1 fig.).

Besides the anti-ambulacral nerve ring in the radialia, he found connectives in the basalia which united in pairs the strands extending from the central organ. The pairs run a separate parallel course to the ring in the radialia and there unite. The chiasma is simpler than in *Antedon*. There is a chiasma in each axillary joint.

The chambered organ has no continuations upwards; its five chambers end blindly. Inferiorly it sends processes into the stalk, and from these in the nodes the vessels of the cirri arise. The organ is lined by a thin connective tissue, with a distinct endothelium. All its parts contain dark granules of unknown nature. In the upper portion of the organ delicate strands of connective tissue without lime run from wall to wall internally.

From the glandular organ an axial strand passes into the stalk; it consists of a simple tube with a narrow lumen. In the calyx the organ consists of a large number of vesicles, in the midst of which there is a small lumen separated off by cœlomic epithelium, and crossed in its lower part by some strands of connective tissue. On the upper part of the gladular organ there is a large cushion of cells with which vessels from the labial plexus are connected. No direct connection between blood-vessels and the glandular vesicles was seen, but blood-vessels pass under the epithelium enveloping the glandular organs.

The germ-cells arise in the complex apposed to the glandular organ. From this a strand passes close to the gullet to the labial vascular plexus. By branching an abundant network of genital strands is formed beneath the integument of the calyx-operculum. From the network outgrowths pass up the arms to the pinnules. The strands and their outgrowths are double tubes, a blood-vessel round a genital tube. It is hardly possible to distinguish between blood-vascular system and reproductive organs; they are most intimately bound up together.

Limnocodium in Munich Botanic Gardens.*—E. Boecker detected this fresh-water medusoid in the Victoria Regia tanks in the Botanic Gardens at Munich. The specimens seemed to be exclusively males. It is noted that they congregated most abundantly in the tank at the place which was most in the sunshine, but that was also nearest the heating arrangement. They flourished quite well in a glass vessel in a cool room.

Cœlentera.

Stylasterina of Siboga Expedition.†—S. J. Hickson and Helen M. England describe 23 species of Stylasterina, of which 14 are new. The new genus *Steganospora* is established for a form in which the gastrozooids, and also the dactylozooids, are intimately connected by short broad canals.

Ceylonese Alcyoniidæ.‡—Edith M. Pratt reports on a collection made by Professor W. A. Herdman off Ceylon. There are 5 species of *Sarcophytum* (3 new), 2 of *Lobophytum*, 8 of *Sclerophytum* (1 new), and

* Biol. Centralbl., xxv. (1905) pp. 605–6.

† Siboga Exped., viii. (1905) 26 pp. (3 pls.). See also Zool. Zentralbl., xii. (1905) pp. 560–1.

‡ Ceylon Pearl Oyster Fisheries, 1905, Part iii., Supp. Rep. xix. pp. 247–68 (3 pls.).

2 of *Alcyonium* (1 new). There are some interesting notes on geographical distribution, and on the structure of the forms described, e.g. as to cnidoblasts, zoochlorellæ, gonads, and canals.

Maturation of Ovum in Alcyonium digitatum.*—M. D. Hill has reached some remarkable conclusions which, if true, separate the maturation processes in the egg of *Alcyonium* from all hitherto described cases. No polar bodies are formed in the ordinary sense. The division of the female pronucleus before the entrance of the spermatozoon is irregular and amitotic. No chromatin leaves the egg in the stage of ovocyte I., to use Boveri's nomenclature. The female pronucleus completely disappears. There are no bodies that can be termed chromosomes throughout the whole process. The first segmentation nucleus is derived from the male pronucleus, but it is quite possible that chromatin equal in amount to that of the male may also be derived from the female pronucleus, though all trace of the latter has been lost.

Lime-forming Layer of the Madreporarian Polyp.†—Maria M. Ogilvie Gordon refers to Duerden's work on *Siderastrea*, and emphasises the general fact that the ectoderm does not directly separate out calcareous matter, but organic matter, within which the crystals develop. On Professor Duerden's interpretation, we are to believe that the exceedingly particulate skeleton arises by a sort of crystallisation in an organic cuticular matrix produced by, but distinct from, the ectoderm. Mrs. Ogilvie Gordon upholds her opinion, supported by remarkable correspondences of measurements, which cannot be mere coincidences, that the individual ectoderm cells or nuclear parts exert a determining individual influence on the origin of the lime-forming skeletal units (= "calicoblasts" in her work) in the cuticular product, which is, after all, a composite product from many ectodermal cells, and persists in retaining its originally particulate character.

Ciliary Currents in Actiniaria and Madreporaria.‡—Oskar Carlgren has made a precise study of the varied distribution of cilia and the various currents in these forms. He discusses the functions of the cilia, especially in wafting food-particles inwards, and in wafting useless material outwards, and shows that there are four distinct types.

Victorian Graptolites.§—T. S. Hall gives an account of Upper Ordovician Graptolites from the neighbourhood of Mount Wellington. Eight different species are described, several of which are new.

New Species of Hydra.‖—N. Annandale describes from the Calcutta tanks a hydra which he is inclined provisionally to class as *H. orientalis* sp. n. The tentacles and base are milky white, the distal portion of the body is either pale or dark olive-green, deep chestnut, orange-brown, pale-brown, cream colour, or dirty white, never bright green. Every phase of colour may be found in the same tank, but the darker specimens

* Quart. Journ. Micr. Sci., xlix. (1905) pp. 493–505 (7 figs.).
† Tom. cit., pp. 203–11.
‡ Biol. Centralbl., xxv. (1905) pp. 308–22 (6 figs.).
§ Proc. Roy. Soc. Victoria, xviii., n.s. (1905) pp. 20–4 (1 pl.).
‖ Journ. and Proc. Asiatic Soc. Bengal, i. (1905) pp. 72–3.

are more common over deeper water. When kept in a bright light they become almost pure white, whatever the original colour may have been.

Porifera.

Structure of the Styles of Tethya.* —G. C. J. Vosmaer and H. P. Wijsmann have made a study of the structure of the silicious styles of *Tethya lyncurium*. The concentric layering of the silicious substance is said not to be due to the alternation of thick silicious layers and thin organic layers. The whole style consists of an organic axial thread of "spiculin," an external spicule-sheath (in Kölliker's sense), and between these the amorphous layered hydrate of silica ("spicopal").

Genus Receptaculites.†—F. Chapman gives some notes on representatives of this genus from Victoria, and on *R. australis* from Queensland. In Australia the genus ranges from the Silurian to the Carboniferous.

Protozoa.

Cilia and Trichocysts.‡—A. Schuberg has made a detailed study of the minute structure of the cilia and trichocysts in *Stentor cæruleus*, *Paramœcium caudatum*, *Frontonia leucas*, and other forms. He demonstrates a fine "terminal portion" of the more substantial basal portion, and the spiral twisting of the cilium. There is a differentiation into an axial portion and a sheath. There are basal corpuscles at the roots of the cilia. In the trichocysts also there are intricacies: thus the author distinguishes the "head" and the "hair-like process."

Pseudospora volvocis.§—Muriel Robertson describes what seems to be *Pseudospora volvocis* Cienkowski, which Bütschli places among the Isomastigoda. It has three adult forms, amœboid, flagellate, and radial (the last a direct reaction to external conditions). There is a single nucleus with a membrane; it divides by mitosis. In gametogenesis the nucleus becomes converted into a sphere, the nuclear substance of which appears to be derived from the rays of the original cell nucleus. The karyosome is extruded from the sphere. The sphere segments, to form a large number of gametes. The gametes conjugate in pairs, forming zygotes, which develop into the adult form.

Trypanosoma of Rat.‖—K. Byloff has studied the behaviour of *T. lewisi* when inoculated into wild and tame rats. The adults, injected into peritoneal cavity, pass slowly into the blood, and from the second to the fourth day division and young forms appear there. Divisions clearly take place into the peritoneal cavity, the products passing into the blood *via* the lymph and possibly also by direct passage into the vessels. Growth and continued divisions of these forms take place rapidly, resulting in very small elements which are present in con-

* Proc. k. Akad. wiss. Amsterdam (1905) pp. 15–28.
† Proc. Roy. Soc. Victoria, xviii., n.s. (1905) pp. 5–15 (3 pls.).
‡ Arch. Prot., vi.. (1905) pp. 61–110 (2 pls.). See also Zool. Zentralbl., xii. (1905) pp. 799–808.
§ Quart. Journ. Micr. Sci., xlix. (1905) pp. 213–30 (1 pl.).
‖ SB. Akad. Wiss. Wien, cxiii. (1904) pp. 111–38 (2 pls.).

siderable numbers on the third and fourth days. These small forms grow and divide again. Divisions take place by mitosis; the flagellum functions similarly to the centrosomes of other cells.

Chromidia of Protozoa.*—R. Goldschmidt discusses the nuclear material distributed in the plasma of Protozoa, to which R. Hertwig applied the term Chromidia. It seems to be of a two-fold nature—(1) material of trophic function, corresponding to the macronucleus of Ciliata (Mesnil's† "trophochromidia"); (2) material of reproductive function, corresponding to the micronucleus of Ciliata (Mesnil's "idiochromidia," Goldschmidt's "Sporetia"). Both Goldschmidt and Mesnil point to the probable duality of the nucleus in general.

Studies on Sarcodina.‡—E. Penard discusses some fungoid parasites of *Amœba*; the occurrence of uninucleate, binucleate, and multinucleate specimens of *Amœba granulosa* Gruber; *Dinamœba mirabilis* Leidy, which is sometimes much infested with microbes; *Cochliopodium crassiusculum* sp. n., adapted to terrestrial life; *Paulinella chromatophora* Lauterborn, remarkable in its envelope and chromatophore; *Placocysta jurassica* sp. n., and *Arachnula vesiculata* sp. n.

Pathology of Balantidium Coli.§—R. P. Strong has found in Manila that in 99·1 p.c. of the cases (117) of human intestinal infection with *B. coli*, diarrhœa was a prominent symptom. In two cases histological studies showed that the parasites had invaded the coats and vessels of the large intestine. Hogs as well as human beings have been found infected in Manila. Later researches by other investigators confirm the foregoing, and though it has not been demonstrated that *B. coli* produces a primary erosion of the intestine, if such exist, it is certainly capable of continuing the process, and of modifying and producing, in connection with the bacteria which accompany it more or less characteristically pathological lesions.

Piroplasma Canis.‖—G. H. F. Nuttall and G. S. Graham-Smith describe and figure this parasite as observed in stained preparations obtained in infection experiments carried on in Cambridge with infected ticks (*Hæmaphysalis leachi* Andouin) imported from South Africa. The appearance and size of the parasite, its multiplication within the cell, and free and doubtful sexual forms, are described. The paper is an important one, and contains much matter of interest regarding these imperfectly known Protozoa.

Piroplasma in Monkey.¶—P. H. Ross gives an account of a piroplasma from the blood of *Cercopithecus*. Fourteen specimens were examined, all their temperatures were high, and in every case the blood

* Arch. Prot., v. (1904) pp. 126–44.
† Bull. Inst. Pasteur, iii. (1905) 10 pp. (7 figs.). See Zool. Zentralbl., xii. (1905) p. 422.
‡ Rév. Suisse Zool., xiii. (1905) pp. 585–616 (2 pls.).
§ Dept. Intern. Bureau of Gov. Lab., Manila, 1904, pp. 1–75 (5 pls.).
‖ Journ. Hygiene, v. (1905) pp. 237–49 (1 pl.).
¶ Tom. cit., pp. 18–23.

was found to contain *Piroplasma*. Examined in the living condition the pear-shaped body gradually changed its shape, becoming first oval, and then again pear-shaped, but with the thin end now at the opposite extremity. No protrusion of pseudopodia was observed. The parasites varied in size. The more common round form had a diameter of about 1·5 μ. The pear-shaped forms ranged from 2·5 μ by 1·5 μ to 3 μ by 2 μ. The monkeys appear to have been naturally infected, and some of them died. No ticks were found upon them.

BOTANY.

GENERAL,

Including the Anatomy and Physiology of Seed Plants.

Cytology,

including Cell Contents.

Nuclear Division in Yeast.*—M. Swellengrebel gives an historical account of the research on this subject by a succession of workers. He then explains the technique used by others and himself, and finally gives the result of his own observations. Nuclear division is, he states, undoubtedly mitotic. The nucleus, round at first, loses its distinct contour, and some four chromosomes become distinct. These arrange themselves in a band round the equator as a mono-aster. At a later stage, after probable division, they separate and leave the equator, and at length collect at the poles, where they form a diaster stage. The division of the nucleus does not take place at the same time as the cell divides. Cases are often seen where the metaphase is reached before there is any sign of budding.

Nature and Origin of Chromatophores.†—C. Mereschkowsky concludes that chromatophores are not constituent organs of the plant-cells, but represent a kind of special organism living symbiotically in the colourless protoplasm.

GUILLIERMOND, A.—**L'appareil chromidial des Cyanophycées et sa division.** (The chromidial apparatus of the Cyanophyceæ and its division.) *Comptes Rendus Soc. Biol. Paris*, xxxvii. (1905) pp. 635–41.

„ „ **Sur les graines de sécrétion des Cyanophycées.** (On the secretory granules of the Cyanophyceæ.) *Tom. cit.*, pp. 641–3.

Structure and Development.

Vegetative.

Embryo Sac and Embryo of Cucumis sativus.‡—O. I. Tillman in his work on *Cucumis sativus* makes out several points of interest. There are two integuments to the ovule, and these greatly elongate to form a long narrow micropyle, into which projects a neck-like process from the flask-shaped nucellus. The ovule itself, at first orthotropous, soon becomes anatropous, while the embryo retains its original position. The embryo is of small size, is developed irregularly, and is surrounded by endosperm. The pollen-tube on entering the micropyle passes down the nucellus througn special conductive cells to the embryo sac, and on

* Ann. Inst. Pasteur, xix. (1905) pp. 503–15 (1 pl.).
† Biol. Centralbl., xxv. (1905) pp. 593–604, 689–91.
‡ Ohio Naturalist vi. (1906) pp. 423-30 (2 pls.).

entering the latter puts out haustoria-like processes, which in some cases extend as far as the inner integument. These processes appear to absorb and conduct food material to the embryo. This agrees with Longo's observations on the pollen tube of *Cucurbita Pepo*, in which there is a special distribution of starch around the haustoria.

Physiology.

Nutrition and Growth.

Formation of Oxalic Acid by Sterigmatocystis nigra.* — P. G. Charpentier finds that oxalic acid appears in the culture medium where this fungus has grown, but not till after the conidia have been formed, when the fungus diminishes in weight, the medium has lost its acidity, and the inverted sugar is consumed. He concludes that oxalic acid is not an intermediate product of the breaking up of sugar, but that the fungus, after the medium is exhausted, oxidises its reserves, and thus forms oxalic acid.

Organic Acids as a Source of Carbon in Algæ.†—O. Treboux describes a series of experiments which lead to the conclusion that organic acids take part in the supply of nourishment even to plants which themselves possess chlorophyll.

Chemical Changes.

Action of Fungi on Cellulose.‡—H. C. Schellenberg finds from a study of a series of fungi that none of them can dissolve true cellulose. They dissolve several forms of hemicellulose. The resistance of celluloses to the action of the fungi is not the same as their resistance to acids; it depends rather on their molecular constitution. They are dissolved by the action of a ferment which is also found in the bacteria of butyric acid. There are four distinct ferments which act only on hemicelluloses.

Probable Existence of Emulsin in Yeast.§—T. A. Henry and S. J. M. Auld have studied the action of yeast on glucosides, and have shown that the glucosides which are decomposed by yeast are those which are attacked by emulsin, and further, that the conditions under which these decompositions are affected by yeast, especially as regards temperature, are those which recur in the case of emulsin. Hence they conclude that the glucoside-destroying action of yeast is due to the secretion of emulsin in the cells of the plant.

HIRSCH, JULIUS—**Der Einfluss von Formaldehyde auf Vermehrungsenergie und Gärungsenergie, sowie auf die Generationsdauer verschiedener Hefearten.** (The influence of formaldehyde on the increase and the fermentative energy, as also on the persistence of different species of yeast.)
Mitt. Oesterr. Versuchs.-St. Akad. Brauind. Wien, Allg. Zeitschr. Bierbr. Malzfabr., 1905, No. 32.
See also *Centralbl. Bakt.*, xv. (1905) pp. 664–5.

* Comptes Rendus, cxli. (1905) pp. 367–9, 429–31.
† Ber. Deutsch. Bot. Ges., xxiii. (1905) pp. 432–41.
‡ Arch. Sci. Phys. Nat., xx. (Geneva, 1905) p. 574.
§ Proc. Roy. Soc., Series B, lxxvi. (1905) pp. 568–80.

SHIBATA, K.—**Weitere Mitteilung über die Chemotaxis der Equisetum-Spermatozoiden.** (Further communication on the Chemotaxis of Spermatozoids of *Equisetum.*) *Bot. Mag. Tokyo*, xix. (1905) pp. 126–30.

TREBOUX, O.—**Die Keimung der Moossporen in ihrer Beziehung zum Lichte.** (The germination of moss-spores and its relation to light.) *Ber. Deutsch. Bot. Ges.*, xxiii. (1905) pp. 397–400.

CRYPTOGAMS.

Pteridophyta.

(By A. GEPP, M.A., F.L.S.)

Chloroplast in Selaginella.*—G. Haberlandt describes the protoplasmic layer which lines the concave side of the chloroplast in the epidermal assimilating cells of the leaf of *Selaginella Martensii*. It is highly refractive, 3–4μ thick, homogeneous, and separates the chloroplast from the protoplasm that surrounds the nucleus of the cell. The author describes his microchemical experiments upon it, and discusses its minute structure. He is led to believe that its function is not connected so much with assimilation as with the movements of the chloroplast in response to the stimulus of incident light.

New Genus of Ophioglossaceæ.†—H. L. Lyon has been studying the gametophyte of *Botrychium obliquum* and other species, and, in consequence of the differences observed both in the embryonic development and also in the mature sporophytes of the ternate species, regards the latter group as worthy of segregation in a distinct genus, for which he proposes the name *Sceptridium*, from the sceptre-like sporangiophore. Under this name he enumerates 20 species and 4 varieties. The generic description is as follows:—Stem subterannean, short, erect, with many clustered roots. Sporophyll dividing near the stem into a long-petioled sporangiophore and a shorter-petioled sterile segment. Sporangiophore erect, bi-, tri- or even quadri-pinnate, bearing naked, spherical sporangia in two rows. Sterile segment inserted obliquely near or at the surface of the ground, ternately divided or compound. Gametophyte tuberous, subterranean, saprophytic, monœcious. Embryo with a suspensor and without a pronounced lateral cotyledon; its axis straight, the root emerging from the lower side of the gametophyte.

Alcicornium.‡—L. M. Underwood gives under this revived generic name a revision of the genus *Platycerium*, recognising 13 species. For these he has constructed a synoptical key, to which is added an enumeration bringing together the synonymy, illustrations, and principal references to literature. One new species is described. In an historical account of the genus the author shows by how much nomenclatorial confusion two of the commonest species have been obscured, and has planned out his revision on the lines of the Rochester code. In a footnote, evidence is given that Presl's Epimeliæ Botanicæ, though dated 1849 on the title page, was not published till 1852.

* Ber. Deutsch. Bot. Ges., xxiii. (1905) pp. 441–52 (1 pl.).
† Bot. Gazette, xl. (1905) pp. 455–8 (1 fig.).
‡ Bull. Torrey Bot. Club, xxxii. (1905) pp. 587–96.

Notes on American Ferns.—W. N. Clute* publishes a check list of North American Fern-worts, which contains a chronological account of previous lists, a table of families and tribes, and the first part of a systematic enumeration, with notes on distribution. B. D. Gilbert † supplies notes of observations on four species of Georgia ferns, and on other North American species. G. E. Nichols ‡ records a new habitat for *Schizaea pusilla*, at Cape Breton, the northernmost yet known. A. Nelson § describes *Asplenium Andrewsii*, a new species from Colorado. E. Rosenstock ‖ gives diagnoses and photographic representations of new species and hybrids from South Brazil.

BAYER, A.—**Zur Morphologie der Rhizome von Pteris aquilina.** (On the morphology of the rhizome of *P. aquilina*.) *SB. k. Böhm. Ges. Wiss. Prag*, x. (1904) 8 pp.

CHRIST, H.—**Primitiæ Floræ Costaricensis. Filices.** (First-fruits of the Flora of Costa Rica. Ferns.)
[Descriptions of novel forms and notable species collected by Werckle in the Navarro Valley, which is exceedingly rich in ferns, e.g. *Gleichenia, Cyathea, Aspidium, Polybotrya*.] *Bull. Herb. Boissier*, vi. (1906) pp. 45–58, 159–172.

CHRISTENSEN, C.—**Index Filicum.** (Index of Ferns.)
[*Gleichenia* to *Leptochilus*.] Copenhagen: Hagerup, Dec. 1905, fasc. vi. pp. 321–84.

GRAND'EURY.—**Sur les graines de Sphenopteris, sur l'attribution des Codonospermum, et sur l'extrême variété des "graines de fougères."** (On the seeds of *Sphenopteris*, the position of the *Codonosperma*, and the extreme variation of the seed-bodies of ferns.) *Comptes Rendus*, cxli. (1905) pp. 812–15.

LIÖS, R.—**Anatomische Untersuchungen über die Blattspreite der einheimischen Farne.** (Anatomical studies of the leaf-blade of the indigenous ferns.) Erlangen, 1904, 59 pp.

KOPS, VAN EEDEN & VUYCK.—**Flora Batava. Afbeelding en Beschrijving van Nederlandsche Gewassen.** (Dutch Flora. Figures and descriptions of the plants of the Netherlands.)
[A *Lycopodium* and 4 species of *Isoetes* are figured.] Harlem: Loosjes, 1905, parts 349–52, 20 plates.

MAIDEN, J. H.—**Selaginella lepidophylla.**
[An American species, which is artificially scented with oil of cinnamon and sold in Australia as the "Rose of Jericho."] *Abstr. Proc. R. Soc. N. S. W.*, Oct. 4, 1905, p. iii.

MAIDEN, J. H., & E. BETCHE.—**Notes from the Botanic Garden, Sydney.**
[Contains notes on and a new description of *Marsilia angustifolia*, a North Australian species now recorded for New South Wales. The leaflets are said to be distinctly pinnately arranged.] *Proc. Linn. Soc. N.S.W.*, xxx. (1905) pp. 354–75.

RACIBORSKI, M.—**Orodzaju paproci Allantodia Wall.** (On the Fern-genus *Allantodia* Wall.) *Krakow. Rosprawy Akad. Umiej.*, v. (1905) pp. 166–72.

SCHOUTE, J. C.—**Notiz über die Verästelung der Baumfarne.** (Notes on the branching of tree-ferns.) *Ann. Jard. Bot. Buitenzorg*, sér. ii. 5 (1905) pp. 88–91 (1 pl.).

WOOLSON, G. A.—**A precocious Cystopteris.**
[An instance of *C. bulbifera* on which the bulblets developed into plants without being detached from the frond.] *Fern Bulletin*, xiii. (1905) pp. 99, 100 (1 pl.).

* Fern Bulletin, xiii. (1905) pp. 109–20.
† Tom. cit., pp. 100–4, 108–9.
‡ Tom. cit., pp. 97–8.
§ Proc. Biol. Soc. Washington, xvii. (1904) pp. 173–80.
‖ Festschr. Albert von Bamberg, Gotha, 1905, pp. 56–69.

Bryophyta.

(By A. Gepp.)

Antarctic Mosses.*—J. Cardot, in a preliminary notice on the mosses collected by the Swedish Antarctic Expedition, criticises C. Müller's Bryologia Austro-Georgiæ (1889), in which all but one of the 52 species collected by Will in South Georgia are described as endemic. Cardot, having examined the types, sinks 15 of these endemics, and points out that several of the others have been found elsewhere, leaving 26 truly endemic species. Cardot gives a list of 80 species, representing the South Georgian collections of Skottsberg, of the Swedish Antarctic Expedition, and 21 of them are new to science, including two genera, *Skottsbergia* and *Pseudodistichium*. The total moss-flora of South Georgia consists now of 93 species, 47 of which are endemic, and the rest common to Magellan, Kerguelen, or New Zealand, etc. Only 14 are pleurocarpous. Cardot adds a list of 23 species (5 being new) collected by Skottsberg in the strictly Antarctic regions of Louis Philippe Land, Graham Islands, South Shetlands, etc.

Variability in Philonotis.†—L. Loeske publishes critical notes on some forms of *Philonotis*. Owing to a false appreciation of the value of certain characters, the affinities of the forms have not been rightly established hitherto. *P. laxa* Limpr. is an aquatic form of *P. marchica*, but *P. laxa* Warnst., from Tannenbergsthal, is a parallel form of *P. cæspitosa*. In *P. borealis* Limpr. f. *laxa* Mönkm. we have a parallel form of *P. fontana*. A form of *P. alpicola* that reproduces itself by fragile branchlets has been observed. The same species in high altitudes has been found bearing zones of leaves utterly unlike the typical leaves; this state is probably *P. tomentella* Molendo. Extreme forms of this state differ altogether from *P. alpicola*, and approach *P. borealis* Limpr. Widely different forms are distributed as *P. fontana* var. *falcata*, one of the most pronounced of these being *P. seriata*, which is connected with *P. adpressa* Ferg. by intermediates. An *adpressa*-form of *P. fontana* is also often referred to *P. adpressa* Ferg.

European Hepaticæ.‡—K. Müller publishes the first part of the sixth volume of Rabenhorst's Kryptogamen-Flora, which, though treating primarily of the hepatics of Middle Europe, will include the whole of the European species. No adequate attempt to cover this ground has been made since the publication by Nees of his Naturgeschichte der europäischen Lebermoose (1833–8), an elaborate work in 4 volumes now rather scarce. The present work, though mainly systematic, begins with a summary of the morphology and biology of the hepatics, treating of the position of the hepatics in the vegetable kingdom, their general characters, and their structure. The morphology of the thallus and its appendages, of the corm or leafy shoot, and of the reproductive

* Bull. Herb. Boissier, vi. (1906) pp. 1–17.
† Hedwigia, xlv. (1906) pp. 100–14.
‡ Rabenhorst's Kryptogamen-Flora, vi., 1 (1905) 64 pp., 51 figs. Leipzig, Kummer.

organs, is described; and the chemical composition of the cell-walls, etc., and especially of the oil-bodies, is briefly considered. The systematic part of the work is not yet reached. It is estimated that 15 to 18 parts will be issued.

Development of Fossombronia.*—H. B. Humphrey has made a study of *F. longiseta* Aust., which grows abundantly near Stanford University, in California. The plants are capable of withstanding very great drought during the dry season, and when wetted are often found with the sex-organs in a well advanced stage. Each leaf-lobe in the gametophyte bears a single apical mucilaginous-cell, with the functions of a hair. The germinating spore puts out a long germ-tube containing little chlorophyll and much oil; the first rhizoid appears late. The development of the antheridium is described, and exhibits some relationship with those of *Geothallus* and *Sphærocarpus*. No centrosome was observed during the stages of spermatogenesis; the spermatid mother-cell divides into two spermatids without partition-wall. Blepharoplasts appear *de novo*. The behaviour of these and of the "Nebenkörper" is described. The development of the archegonium, the sporophyte, and spores are fully described.

British Notes and Records.—E. Cleminshaw † records the boreal species, *Tetraplodon Wormskioldii*, previously found by Horrell and Jones in Teesdale, from the peat below Craig Cailleach, Perthshire. P. Ewing ‡ gives a list of the Hepaticæ of the Clyde area; it contains 113 species; 6 are new to Britain and 21 to Scotland. J. McAndrew § gives notes on a few species of *Riccia* from the Pentlands. During the drought the Pentland reservoirs and their feeding streams were at a very low level, and five species of *Riccia* were found growing in abundance on the exposed and drying mud: *R. sorocarpa*, *R. glauca*, *R. crystallina* (first record for Scotland), *R. glaucescens* or *Lescuriana*, *R. fluitans*. The latter, associated with *Fossombronia cristata*, occurred along the bank of a stream. J. Murray ‖ records three aquatic mosses from St. Kilda, namely, *Fontinalis antipyretica*, *Racomitrium aciculare*, and *Grimmia apocarpa*.

Tasmanian Mosses.¶—W. A. Weymouth, in a third paper on the subject, gives the names of 9 new mosses, 5 of them with descriptions, by Brotherus; a list of 11 species, not previously recorded, for Tasmania; the names of 17 new species of hepatics determined by Stephani; and a list of 92 hepatics, new records for Tasmania.

Bryological Fragments.**—V. Schiffner gives notes on the following:—discovery of *Pallavicinia Lyellii* in Austria; *Marsupella erythrorhiza*, an addition to the Belgian flora; new stations for rare mosses in the Riesengebirge; remarks on *Grimaldia carnica* C. Mass.; *Pallavicinia*

* Ann. of Bot., xx. (1906) pp. 83–108 (2 pls., 8 figs.).
† Journ. of Bot., xliv. (1906) p. 72.
‡ Trans. Nat. Hist. Soc. Glasgow, vii., 1 (1904) pp. 52–8.
§ Trans. Edinb. Field Nat. Micr. Soc., v. (1905) pp. 227–8.
‖ Ann. Scot. Nat. Hist., 1905, pp. 94–6.
¶ Proc. R. Soc. Tasmania, 1902 (1903) pp. 115–32.
** Oesterr. bot. Zeitschr., lvi. (1906) pp. 20–7.

rubristipa Schiffn. sp. n.; on the occurrence of *Lophozia Wenzelii* in Upper Austria; a hepatic new to North America (*Lophozia confertifolia*).

ARNELL, H. W.—**Martinellia Massalongii (C. Mueller), ein Bürger der Schwedischen Moosflora.** (An addition to the Swedish moss-flora.)
[Description of this species, previously gathered once only, at Verona.]
Bot. Notiser, 1905, pp. 315–16.

BALLÉ, E.—**Contribution à la flore bryologique des environs de Vire, Calvados.** (Contribution to the moss-flora of Vire in Calvados.)
[An enumeration of the local species of *Barbula*, classified according to two schemes, one of which depends on the transverse section of the midrib.]
Bull. Acad. Internat. Géogr. Bot., xv. (1906) pp. 34–9.

BAUER, E.—**Laub- und Lebermoose von Porto Alegre. Verzeichnis der von Ed. M. Reineck und Jos. Czermak, 1897–9, in Brasilien gesammelten Bryophyten.** (Mosses and hepatics of Porto Alegre. List of the Bryophytes collected in Brazil by Reineck and Czermak, 1897–9.)
[The species are arranged according to localities, etc.; a few are new, but are not described.] *Verh. k. k. Zool. Bot. Ges. Wien*, lv. (1905) pp. 575–80.

BOLLETER, E.—**Fegatella conica (L.) Corda. Morphologisch-physiologische Monographie.** (A monograph of its morphology and physiology.)
Zurich: 1905, 8vo, 82 pp., 1 pl., 16 figs.

BRITTON, E. G.—**Goebel's Organography of Plants.**
[A brief synopsis of the references here made to the Bryophyta.]
Bryologist, ix. (1906) pp. 10–12.

BROTHERUS, V. F.—**Fragmenta ad floram bryologicam Asiæ orientalis cognoscendam.** (Fragments towards a knowledge of the moss-flora of East Asia.)
Trav. Soc. I. Russe Geogr., vii. 3 (1904) pp. 10–19.

CARDOT, J., & I. THÉRIOT.—**New or unrecorded Mosses of North America.**
Bryologist, ix. (1906) pp. 6–10.

DUSÉN, P.—**Musci nonnulli novi e Fuegia et Patagonia reportati.** (Some new mosses from Tierra del Fuego and Patagonia.)
[Contains descriptions of 31 new species and 3 new genera—*Neobarbula* (Pottiaceæ), *Camptodontium* (Grimmiaceæ), *Muelleriella* (Orthotrichaceæ.] *Bot. Notiser*, 1905, pp. 299–310.

FLEISCHER, M.—**Neue Familien, Gattungen und Arten der Laubmoose. Schluss.** (New families, genera, and species of mosses. Conclusion.)
[Contains *Trachypodopsis* (with 20 species), *Baldwiniella*, *Bissetia*, *Homaliodendron* (18 species), *Pinnatella* (18 species), *Pensigiella*.]
Hedwigia, xlv. (1906) pp. 65–87.

GUGELBERG, M. VON.—**Uebersicht der Laubmoose des Kantons Graubünden, nach den Ergebnissen der bisherigen Forschung.** (A general view of the mosses of Canton Graubunden, according to the results of investigations up to the present time.) *Jahrb. nat. Ges. Graubündens*, xlvii. (1905) pp. 3–122.

HAGEN, J.—**Musci Norvegiæ borealis.** (Mosses of Northern Norway.)
[An account of the mosses collected by Arnell, Fridtz, Kaalaas, Kaurin, Ryan, Hagen and others, between 1886 and 1897.]
Tromsö Museums Aarshefter, 21–22 (1899–1904) xxiv. and 382 pp. (2 pls.).

HAYNES, C. C.—**Cephalozia Francisci (Hook.) Dumort.**
[Description and notes]. *Bryologist*, ix. (1906) pp. 5–6 (figs.).

HERZOG, T.—**Die Laubmoose Badens. Eine bryogeographische Skizze.** (The moss flora of Baden. A bryogeographical sketch.)
[Continuation. Analysis of the moss-flora of the beechwoods and mixed wood of the Black Forest. Also a comparison with the moss-flora of the Vosges.] *Bull. Herb. Boissier*, vi. (1906) pp. 121–37.

IKENO, S.—**Are the Centrosomes in the Antheridial Cells of Marchantia polymorpha imaginary?**
[They are distinct and constant structures.]
Bot. Mag. Tokyo, xix. (1905) pp. 111–13.

KATIC, D.—**Beitrag zur Moosflora von Serbien.** (Contribution to the moss-flora of Servia.)
[A short chronological account of previous work done, followed by lists of the commoner and rarer species collected by the author. A new species, *Encalypta serbica*, is described.] *Hedwigia*, xlv. (1906) pp. 92–9.

PARIS, E. G.—**Index Bryologicus.** (Index of mosses.)
[Continuation. *Rhaphidostegium* to *Thamnium*.]
Paris: Hermann, 1905, fasc. xxii.–xxiv., pp. 185–368.

SCHIFFNER, V.—**Kritische Bemerkungen über die europäischen Lebermoose mit Bezug auf die Exemplare des exsiccatenwerkes IV.** (Critical notes on the European hepatics, with reference to the specimens of the fourth series of Exsiccatae. *SB. Deutsch. Nat. Med. Ver. Prag*, "*Lotos*," xxv. (1905) pp. 109–170.

SMITH, A.—**Plants at Moortown.**
[Records *inter alia* the occurrence of *Ricciocarpus natans*, and of its var. *terrestris*—the spore-bearing state of the plant.]
Naturalist, No. 587 (1905) p. 363.

STEPHANI, F.—**Hepaticæ of Mt. Kōya.**
[List of 36 hepatics.]
Bot. Mag. Tokyo, xix. (1905) p. (266).

" " **Species Hepaticarum.**
[Index and title-page to vol. ii.]
Bull. Herb. Boissier, vi. (1906) pp. 59–77.

THÉRIOT, I.—**Diagnoses de Quelques Mousses nouvelles.** (Description of some new mosses.)
[A preliminary publication of nine species from New Granada, China, Hongkong.] *Bull. Acad. Internat. Géogr. Bot.*, xv. (1906) p. 40.

TORKA, V.—**Bryum badium Bruch.**
[Though rare elsewhere, this plant is common near Schwiebus. The author describes seven variations of sporogonium caused by variations of soil on which the plants grew.] *Hedwigia*, xlv. (1906) pp. 115–18 (figs.).

Thallophyta.

Algæ.

(By E. S. GEPP.)

British Marine Algæ.*—E. A. L. Batters publishes some interesting notes on eleven new or critical species of British marine algæ, of which two are new to science, and at least three are representatives of genera never before found in Britain. The novelties are *Diplocolon Codii*, which is epiphytic between the cortical cells of *Codium tomentosum*; and *Mesogloia neglecta*, which greatly resembles *M. Griffithsiana*, but is distinguished by the very much shorter cortical filaments and the proportionally large spores. The other species treated of are: *Chlorogloea tuberculosa* Wille, *Chætobolus gibbus* Rosenv., *Ulothrix consociata* Wille, *Leptonema lucifugum* Kuck., *Leathesia crispa* Harv., here first recorded from Ireland; *Dictyota spiralis* Mont., *Acrochætium Alariæ*, *Rhodochorton penicilliforme* Rosenv., and *Rhododermis elegans* Cronan var.

* Journ. of Bot., xliv. (1906) pp. 1–3 (1 pl.).

Zostericola Batt. A plate is given which shows *Dictyota spiralis* and the two new species.

Phycological Studies.* —M. A. Howe continues his studies on marine algæ, based on material collected by himself in the West Indies. He describes as new species, *Halimeda favulosa*, *Avrainvillea levis*, *Cladocephalus scoparius*, the type of a new genus between *Avrainvillea* and *Udotea*, *Sarcomenia filamentosa*, and *Dudresnaya crassa*. Critical notes are given on *Caulerpa crassifolia*, *C. sertularioides*, *Acetabulum Farlowii*, *Batophora Oerstedi*, and its variety *occidentalis* (= *Dasycladus occidentalis* Harv.), *Neomeris Cokeri*, *Fucus spiralis*, and *F. Poitei*. Al these notes contain valuable information as to types, synonymy, and habitat, the author having collected many of the species. His notes o the original types, seen by him in various European herbaria, ar specially valuable.

Floating Marine Algæ.†—L. K. Rosenvinge has made a study o the marine algæ thrown up on the west coast of Jutland, and he enu merates them and adds notes on their place of origin and conditio No less than 44 species have been carried over from foreign shore either by the current which flows from the English Channel along th Dutch and German coasts, or by that which passes from the Atlanti along the North of Scotland, down the Eastern coasts of Great Britai and across the North Sea. Of these 44 species, 39 were brought ov by *Ascophyllum* and *Himanthalia*, and 5 were fixed on floating plank The species which has travelled furthest is a *Laminaria*, with a hollo stem, which may be *L. longicruris*, from Greenland or North Americ or it may be *L. faeroensis*, from the Faeroes and East Iceland. Of t 44 species, 27 were found bearing organs of reproduction, and the auth is inclined to think that, in many cases at least, the spores are capable germination. The fact that many of these species are not found livi on the coast is probably due to the unsuitable conditions which obta there.

Principle of Systematising Corallinæ.‡—K. Yendo has made fu ther studies on the group of the Corallinæ, and he publishes his vie on the validity of certain characters from the point of view of clas fication. He considers the most reliable character to be that of t reproductive organs; then the internal, and finally the external struct of the thallus. He deals, first, with "propagating organs," and sh the difficulties of distinguishing the genera satisfactorily. He finds t in plants placed hitherto in *Amphiroa*, the spores are sometimes medullary and sometimes of cortical origin, but always constant in and the same species. "Ramification" forms the next subject, and is followed by remarks on articuli and genicula. The geniculatio regarded by the author as the steadiest character next to the mod fertilisation. The whole of this work is to be published at gre length and in more detail in the 'Journal' of the College of Scie Tokyo.

* Bull. Torrey Bot. Club, xxxii. (1905) pp. 563–586 (7 pls).
† Bot. Tidssk., xxvii. (1905) pp. 83–106. French résumé.
‡ Bot. Mag. Tokyo, xix. (1905) pp. 115–26.

New Genus of Chlorophyceæ.*—A. Borzi describes a new genus of Chroolepidaceæ, *Zoddæa*, allied to *Pilinia* Kutz., *Microthamnion* Kutz., and *Leptosira* Borzi. It contains a single species, *Z. viridis*, which grows on the damp volcanic rocks of the island of Linosa in the Mediterranean. It spreads itself as a green membranaceous crust over the substratum, is 200–300 μ high, and consists of a mass of confervoid filaments, which are much branched, and generally from one side only. The interior of the mass gradually comes to have an almost parenchymatous appearance, but at the surface the filaments are quite distinct. A characteristic of this new genus is the presence of a single parietal chromatophore inside each cell, shaped like a disk, and destitute of pyrenoids and starch.

British Desmidiaceæ.†—W. & G. S. West have brought out the second volume of their monograph of the British Desmidiaceæ. It continues the treatment of the Cosmarieæ, and deals fully with the genera *Euastrum*, *Micrasterias*, and *Cosmarium*. Two new species, *Euastrum cornubiense* and *Cosmarium subquadrans*, and five new varieties of existing species are described. There are 32 plates, containing both coloured and uncoloured figures.

Desmids of New Hampshire.‡—J. A. Cushman concludes his list of Desmids from New Hampshire, in which he records 253 species and varieties. Up to the present time only 74 species had been recorded from that State, so that 179 additions have been made by the author. He notes that a granitic country, or one with old geological rocks, furnishes a greater number of species than a soil of younger geological origin. Thus from a single collection made at Pudding Pond, North Conway, there were identified 126 species and varieties, exactly one half of the whole number recorded from all sources in the State. The author anticipates that many more species will yet be recorded from New Hampshire.

Plankton of Danish and Scottish Lakes.§ — C. Wesenberg-Lund, who has published the results of his various studies on the plankton of Danish Lakes, now makes a comparison between that and the plankton of the lochs of the Caledonian Canal and a few Lowland lakes, especially Loch Leven. His remarks are placed under the following headings: General remarks on the natural conditions of the Danish and Scottish lakes; the organisms, and their relations to the different life-conditions; the influence of the organic life upon the lakes themselves and their surroundings. A few words on his visit to the Lowland lakes are followed by some general conclusions not connected with algæ, and a bibliography. In comparing the organisms of Denmark and Scotland, he notes the great difference in almost every particular. The Scotch lochs are marked by an excess of humic acid and a total absence of lime. The Cyanophyceæ are not abundant, nor are certain of the Diatoms; while the Desmids are astonishingly rich and varied. This rich Desmid

* Nuov. Notar., xvii. (1906) pp. 14–16.
† Printed for the Ray Society, London, 1905, x. and 204 pp., 32 pls.
‡ Rhodora, vii. (1905) pp. 251–66.
§ Proc. Roy Soc. Edinburgh, xxv. (1905) pp. 401–48 (2 pls.).

flora is explained by the author in a plausible theory, which is that the Desmids are constantly being renewed from the surrounding moss-covered hills and bogs which are their natural habitat. He points out, too, that adaptation to their new habitat is gradually taking place, as is shown in the elongation of spines, etc. The quantity of plankton in the Highland lochs is very poor relatively, and the effect of the more even temperature in Scotland is shown by the far less pronounced seasonal change than is found in the Danish lakes. The water of Scotch lochs is not affected in colour by the plankton, and the deposition of organic matter is small. The depth of the Scotch lochs is greater than that of the Danish lakes, and they are also of a more permanent character.

Phytoplankton of Lake Thau.*—J. Pavillard has made a detailed study of the phytoplankton of this small lake, near the zoological station of Cette. He divides his paper into four parts. The first is devoted to a general description of the lake, considered from the geographical and physiographical point of view. The second part treats of the vegetation in the environs of the lake, namely, that of the dunes and dry sea-sand, the damp sand and brackish water, and the phyto benthos. This leads on to the principal part of the paper, which deals with the phytoplankton from the quantitative and qualitative points of view. The species found are enumerated, and references are given to synonyms and literature, as well as occasional notes as to the season of greatest abundance of the species. The fourth section deals with questions of distribution, and with formations and associations. A list of bibliography is followed by a map of the lake and its surroundings and three plates.

Plankton from the Schönenbodensee.† — M. Tanner-Fullema describes a new plankton organism, *Rhapidium Chodati*, and gives lists of the summer and autumn plankton of the above-mentioned lake near Wildhaus, in St. Gall canton. *R. Chodati* occurs abundantly, *Ceratium* rare, and *Asterionella gracillima* is usually absent.

Phytoplankton of the Antarctic Ocean.‡—G. Karsten's report on the phytoplankton collected by the German Deep-sea Expedition, on board the 'Valdivia,' not only brings together for the first time a complete list of Antarctic species, but also deals with questions of supreme interest regarding the distribution, biology, and development of plankton algæ. His work deals with the vertical distribution of the species and the qualitative variation in the successive zones of depth; the effect of light and darkness on certain genera; on dimorphism; resting spores; microspores; the effect of ocean currents on distribution; and many other equally important subjects. The bulk of living plant-organisms is almost entirely confined to the upper layer of 200 m, the maximum occurring between 40–80 m. The nature of the plankton characteristic of the different depths is analysed. In the systema

* Inst. Bot. Université Montpellier, Mém. 2 (1905) 116 pp., map, 3 pls.
† Bull. Herb. Boissier, vi. (1906) pp. 156–8 (1 pl.).
‡ Wiss. Ergeb. deutsch. Tiefsee-Expedition-Valdivia, 1898–99, ii. Jena, 19
19 pls.

part 86 new species are described, of which 82 are diatoms, and one represents a new genus of Halosphæraceæ. The author takes special note of the form and position of the chromatophores as a systematic character.

Bulgarian Algæ.*—St. Petkoff gives a list of 89 fresh-water algæ, not including Diatoms, collected in three localities on the heights of the Rila in Bulgaria. Twenty-four species are new records for Bulgaria. The same author † records, with critical notes, some marine and brackish water algæ from the Bulgarian shores of the Black Sea, from Atlinan to Douran-Koulak; the list contains 49 species.

Peridineæ.‡—G. Entz publishes an account in German of the principal points contained in two papers which have already appeared in the Hungarian language. The first contains an enumeration of Peridineæ, Silico-flagellatæ and Bacillariaceæ from the Quarnero, together with remarks on the plankton of that part, with especial regard to the variation of the *Ceratia*. The second of the Hungarian papers consists of two parts, of which only the second is published here. It contains observations on various morphological conditions, on the division, development and homologies of *Phalacroma Jourdani*, *Ceratocorys horrida*, and the genus *Ceratium*.

CHASE, H. H.—**Flora michiganensis: Algæ; Diatomaceæ.**
[A list of Michigan Diatomaceæ.]
Ann. Rep. Mich. Acad. Sci., v. (1904) pp. 166–9.

ELENKIN, A.—**Beschreibung der neuen Art: Lithothamnion murmanicum Elenkin.** (Description of a new species.)
[Found at a depth of 20–100 feet off the Murman coast; is distinguished from all allies by its two-spored sporangium, and belongs to the group Evanidæ. Its habit is much influenced by physical factors.]
Bull. Jard. Impér. Bot. St. Pétersbourg, v. 5, 6 (1905) pp. 189–94.

GUÉGUEN, F.—**Sur la conservation des algues d'eau douce.** (On the preservation of fresh-water algæ.) *Bull. Sc. Pharm.*, xii. (1905) p. 289.

HUBER, G.—**Monographische Studien im Gebiete der Montigglerseen (Süd Tirol) mit besonderer Berücksichtigung ihrer Biologie. (Schluss.)** (Monographical studies in the region of the Montiggler Lakes in South Tyrol, with special regard to their biology. Conclusion.)
Arch. Hydrobiol. u. Plankton, i, 2 (1905).

MAZZA, A.—**Saggio di Algologia Oceanica.** (Essay in oceanic algology.)
[A continuation. Deals with the genera *Scinaia*, *Galaxaura*, *Chætangium*, *Choreocolax*, and *Wrangelia*.] *Nuov. Notar.*, xvii. (1906) pp. 1–13.

MIGULA, W.—**Kryptogamen-Flora. Algen.** (Cryptogamic-flora. Algæ.)
[Diatomaceæ: *Campyloneis* to *Diploneis*.]
Thomé's Flora von Deutschland, vi. lief 25, pp. 209–24 (5 pls.).
Gera: Zezschwitz, 1905.

MOTTIER, D. M.—**The Development of the Spermatozoid of Chara.**
Proc. Ind. Acad. Sci., 1903–4, p. 137.

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* Period. Spissanié, lxvi. (1905) pp. 222–39.
† Ann. de l'Université de Sofia, i. (1905) pp. 168–80.
‡ Math. Naturwiss. Ber. Ungarn, xx. (1902). Leipzig, 1905, pp. 96–144 (66 figs.).

STRASBURGER, E.—**Zur Frage Eines Generationswechsels bei Phæophyceen.** (On the question of alternation of generations in Phæophyceæ.)
[Treats of the subject from the point of view of the changes in the nuclear structure.] *Bot. Zeit.*, lxiv. (1906) pp. 1-7.

TOBLER, F.—**Ueber Regeneration und Polarität sowie verwandte Wachsthumsvorgänge bei Polysiphonia und anderen Algen.** (On regeneration and polarity, as well as allied phenomena of growth in *Polysiphonia* and other algæ.) *Jahrb. Wiss. Bot.*, xlii. (1905) pp. 461-502 (3 pls.).

WALKER, N.—**Pond Vegetation.**
[A study of the vegetation in ponds near Bramhope, Leeds. In addition to the Phanerogams, were found abundant plankton—*Peridinum tabulatum* and Cyanophyceæ; also in winter occurred associations of *Œdogonium* and *Tribonema*; and in summer of *Mougeotia, Spirogyra, Tolypothrix, Anabæna, Phormidium, Microcystis*.] *Naturalist*, No. 585 (1905) pp. 305-11.

YENDO, K.—**Plankton Diatoms of Misaki.** [In Japanese.] *Bot. Mag. Tokyo*, xix. (1905) pp. 257-65.

ZERNOV, S.—**Sur le changement annuel du plancton de la Mer Noire dans le baie de Sébastopol.** (On the annual change of plankton of the Black Sea in the Bay of Sebastopol.) *Bull. Accad. I. Sci., St. Petersbourg*, ser. 4, xx. (1904).

Fungi.

(By A. LORRAIN SMITH, F.L.S.)

Marine Phycomycetes.*—H. E. Petersen presents a study of Chytridineæ parasitic on various marine algæ, most of which he has collected and examined himself. As a rule, the only stage recognisable in the specimens is the sporangial stage, and it is extremely difficult to follow the development, as the zoospores die off in the cultures, partly, no doubt, on account of the different conditions between the open sea and the culture tanks. Petersen collected on the coast of Denmark and further north. He found specimens most readily in quiet water where the force of the waves was less powerful. He reviews in all 25 species, which he groups under two divisions: Monolpidiaceæ, Eurychasmaceæ, and Merolpidiaceæ under Myxochytridinæ; Holochytriaceæ and Sporochytriaceæ under Mycochytridinæ.

Studies in Erysiphaceæ.†—E. S. Salmon publishes a paper on endophytic adaptation shown by *Erysiphe graminis* under cultural conditions. This fungus has always been regarded as a strict ectoparasite the hyphæ of the mycelium being confined to the external surface of the epidermis, and merely sending haustoria into the epidermal cells. On sowing conidia of the fungus on a wounded portion of a leaf, he found that the fungus had grown down into the tissues of the leaf, as far as the lower epidermis. Patches of conidiophores were formed on the surface of the wound, and conidiophores were also produced in the intercellular spaces. They grew usually in a vertical position, but in some cases they were seen in a horizontal position. The writer suggests that other species of Erysiphaceæ, while normally ectoparasites, may take advantage of wounds or punctures to penetrate the leaf.

* Overs. k. Danske Vidensk. Selsk. Forh., No. 5 (1905) pp. 439-88 (11 figs.).
† Phil. Trans., Series B, cxcviii. (1905) pp. 87-97.

R. Maire * in his paper on Erysiphaceæ makes a series of systematic notes on several species; he then criticises Salmon's views as to *E. taurica* being the type of a new genus on account of its endophytic character, the branched conidiophores, and the single terminal conidium. He states that internal mycelium exists in several other species. He notes further that endophytic mycelium is associated with thickened walls in the epidermal cells of the host or with the existence of a hypodermal layer which renders the surface of the host-plants badly adapted to nourish the fungus. Endophytic mycelium in Erysiphaceæ represents an adaptation of the parasite to the conditions of the host, and not a primitive or generic character.

Hypocrea riccioidea.†—James McAndrew calls attention to this rare fungus, which has been found by him in four localities in New Galloway. "It grows on dead willow in damp marshy places, and when in vigorous growth forms conspicuous patches of a fleshy, orange, and lobed appearance like a *Riccia*." It had previously been found by Bolton in 1790, and it has been collected in Mecklenburg, and in France near Limoges.

Fertilisation in Sphærotheca.‡—V. H. Blackman and H. C. Fraser record some observations made on *Sphærotheca Humuli*, which confirm Harper's views of fertilisation in this fungus. They find oogonium and antheridium close together, and with open communication between the two organs. Each is nucleated at first, then when two nuclei are visible in the oogonium the antheridium is seen to be empty. They regard the oogonium as a "uninucleate ascogonium, which, after fertilisation, develops into a row of cells—the ascogenous hypha of which the penultimate cell becomes the ascus."

Biology of Stictis Panizzei.§—G. Cuboni has continued his study of this fungus, which causes the disease of olive-trees termed "brusca." He finds that on the under side of the leaf pycnidia are produced in large numbers early in the season. At a later stage *Stictis* is formed on the upper surface. He found, also, that the condition of the leaves had much to do with the growth of the fungus—if the acidity was high, then they were receptive to the parasite.

Sclerotial Disease of Forsythia.‖—A. Osterwalder describes a disease of this plant, which is attacked by the fungus at the time of blossoming. The flower is infected, and the mycelium passes down to the branches and kills them. Though the decaying flowers were infested with *Botrytis cinerea*, culture experiments proved that the fungus that had penetrated the branches and killed them was not identical with the *Botrytis*. It formed sclerotia, but never any conidia. Sclerotia were collected from the diseased plants, and, when placed in favourable conditions, they developed apothecia, which proved to be identical with

* Bull. Soc. Sci. Nancy, ser. 3, vi., fasc. 2 (1905) pp. 31–7 (1 pl.). See also Bot. Centralbl., xcix. (1905) pp. 618–19.
† Trans. Edinb. Field Nat. Club, v. (1905) p. 169.
‡ Ann. of Bot., xix. (1905) pp. 367–9.
§ Atti R. Accad. Lincei, cccii. (1905) pp. 730–3.
‖ Zeitschr. Pflanzenkr., xv. (1905) pp. 321–9 (1 pl.).

Sclerotinia Libertiana. It was found that the ascospores could not directly infect the living tissue: they germinated on the withering flower-petals, and infection always took place just as the flower decayed.

Underground Fungi in Hungary.*—L. Hollós has unearthed quite a number of truffles and other underground fungi in the "Pester Comitat." It is a dry region, peculiarly poor in fungi, where only evanescent forms, such as *Coprinus*, or those that could withstand drought, like Lycopedineæ, were to be found. There is not much wooded land, and the trees are chiefly oaks, with a few poplars; the age of the trees was from 20–25 years. Hollós made use of a sow to determine the localities where truffles were to be sought. They grew at the edge of the wood, or in some light place. Fourteen species are recorded, two of them only known from France, and one, *Elaphomyces rubescens*, only from Hesse-Nassau.

Life-History of Hypocrea alutacea.†—This fungus has generally been regarded as a parasite on species of *Clavaria* or *Spathularia*, the mature form being very much like either of these fungi. G. F. Atkinson has now made cultures of the fungus on slices of *Lactarius*, and has proved that it is an autonomous species saprophytic on various substances. Other species of *Hypocrea* form low cushions or incrustations in which the perithecia are imbedded, and Atkinson considers that the genus *Podostroma* Karst., founded on a species, *P. leucopus*, that grew on a decaying insect, should be revived. The description given by Karsten fits exactly the species *H. alutacea*, the only difference being that of habitat; it is therefore proposed to name the plant *Podostroma alutacea*. Atkinson includes under the species Karsten's *P. leucopus*, and also *Hypocrea Lloydii*, recently described by Bresadola, but not differing materially from *P. alutacea*.

Aspergillus bronchialis.‡—Fritz Blumentrett describes this fungus, discovered by him. He compares it with *A. fumigatus*, and gives an account of the various cultures of each species on potato, sugar, alkaline and acid substrata, gelatin, and on moist rice. Detailed accounts of the growth of the fungi are tabulated.

Hyphomycete Parasitic on the Vine.§—L. Gabboto describes tubercles on vine branches caused by the presence of the fungus *Pionnotes Cesatii*. Incidentally, he remarks that he found no trace of the lichen-characters ascribed to the plant by Briosi and Farneti. *Pionnotes* forms a thin red crust on the branches, and conidia are produced at the tips of the branching hyphæ. The mycelium penetrates the tissue of the vine, resulting in hypertrophy and deformation of the infected parts, and causing much damage to the vines. Advice is given as to the best means of checking the disease.

Disease of Pear-Trees.‖—Rodolfo Farneti states that some varieties of pears are almost constantly more or less covered with brown spots,

* Math. Naturwiss. Ber. Ungarn., xx. (1905) pp. 307–11.
† Bot. Gazette, xl. (1905) pp. 401–16 (3 pls.)
‡ Ber. Deutsch. Bot. Ges., xxiii. (1904) pp. 419–27 (1 pl.).
§ Nuovo Giorn. Bot. Ital., xii. (1905) pp. 488–93 (1 fig.).
‖ Ann. Mycol., iii. (1905) pp. 433–6 (5 figs.).

due to a parasitic fungus, *Macrosporium Sydowianum* sp. n. The damage is confined to the surface of the fruit, the interior tissue not being affected; but when the fruit is attacked at an early stage its growth is stopped. Spore-development is described, and a diagnosis of the species is added.

Rhacodium Cellare as a Hemiparasite.*—Vittorio Peglion describes a case in which the cellar fungus, a saprophyte, developed as a parasite, attacking stored chestnuts, and sometimes destroying large numbers of them. The mycelium is white at first, but becomes deep brown with age. The fructification recalls that of *Cladosporium*, *Cladotrichum*, etc.

Biology of Helminthosporium gramineum.†—F. Noack confirms the work already done by Diedicke on this fungus, and adds notes and observations that he himself has made. Towards the end of the year the fungus forms sclerotia, which have been found on barley stubble, and on these are produced perithecia of *Pleospora trichostoma*. The author made cultures of the ascospores, and got again the mycelium and spores of *H. gramineum*. The "streak" disease due to this fungus is produced in the early part of the year, and may arise from mycelium in the chaff of the seed, from conidia adhering to the seed, from the first beginnings of sclerotia attached to the sheaths, or from ascospores. The author considers that the disease causes considerable loss. The fungus grows only on *Hordeum distichium*. Deep ploughing of the stubble would be advisable to prevent the spread of the disease.

Vegetative Life of the Rust Fungus.‡—Jacob Eriksson continues his studies on Uredineæ. He passes in review the possible methods of development of these fungi. He caused all barberry bushes to be uprooted in the near neighbourhood of his experimental plots, and shows the impossibility of infection having taken place from æcidiospores. He thinks it possible that infection may be caused by sporidia, though that has not been proved experimentally. Wintering of the fungus he states is impossible in the uredo stage. Eriksson examined young blades of grass, where the fungus might be expected to appear, and found no trace of mycelium, but he found the more dense condition of the protoplasm indicating the presence of mycoplasma. At more advanced stages he saw the mycoplasm developing to fungus mycelium, and the disorganisation of the host-cells.

Uredineæ.—I. Vestergren § has prepared a monograph of the species of *Uromyces* that grow on *Bauhinia*. The material was collected mostly in Brazil. Only one species has been found in the Old World, *Uromyces verruculosus* on *Bauhinia tomentosa*, in Ceylon. Vestergren gives an account of 17 species, several of which are new.

H. O. Juel ‖ has conducted a series of culture experiments with the

* Atti R. Accad. Lincei, cccii. (1905) pp. 740–3.
† Zeitschr. Pflanzenkr., heft 4 (1905). See also Centralbl. Bakt., xv. (1905) pp. 484–5.
‡ Kgl. Svenska. Vetensk. Akad. Handl., xxxix. No. 5 (1905) pp. 1-41 (2 pls.). See also Bot. Centralbl., xcix. (1905) pp. 586–7.
§ Arkiv Bot., iv. No. 15 (1905) 34 pp., 2 pls.
‖ Op. cit., No. 16 (190) 5 pp., 1 fig.

Æcidium found on *Ranunculus auricomus*. He finds that the alternate form is *Uromyces pratensis*—the uredo- and teleutospore forms—parasitic on *Poa pratensis*.

Feodor Bucholtz * has made a list of the species of *Puccinia* that have been found in the Baltic provinces of Russia. Such a list, he holds, is most useful in determining the various life-histories. Thus, if one or other form of a heterœcious rust is constantly found in a locality where the alternate host does not grow, the fungus must be able to survive without changing its host. Bucholtz records 102 species, two of which are new. He adds critical notes to many of the species.

A series of culture experiments have been made by Ed. Fischer † on Uredineæ. He found that spores of *Pucciniastrum Padi*, when sown on the twigs of firs, only produced mycelium in the tissues; when sown on the flower, æcidia and pycnidia grew in great abundance on the scales of the cones. He has proved also that *Puccinia liliacearum* grows on *Ornithogalum* alone, without an alternative host.

O. Schneider † has continued his work on the Melampsoræ of willows. He establishes two new species, *Melampsora Ribesii-grandifoliæ*, the two hosts being *Ribes alpinum* and *Salix grandifolia*; and *M. Larici-reticulata*, the cæoma form of which is found on *Larix*, the other forms on *Salix reticulata* and *S. hastata*, more sparingly on *S. herbacea*. He notes as a result of his experiments on *Melampsora*, that many species morphologically similar develop biological differences when there is a wide geographical difference in locality. He contrasts this finding with the specialisation of *Puccinia graminis*, that has been observed in North America and in Sweden.

Alfred Hasler ‡ has determined by culture experiment the hosts of six forms of Uredineæ, all species of *Crepis*. He attempted to grow *Puccinia Centaureæ* on 18 different species of *Centaurea*. It developed only on *C. valesiaca* and *C. Cyanus*.

Walther Krieg § records the results of cultures with the æcidiospores collected from species of Ranunculaceæ. His results with *Æcidium Ficariæ* were not all absolutely certain, as the host-plants were gathered in the open, and were not free from the suspicion of previous infection. From *Ranunculus auricomus* he transferred the fungus to *Poa pratensis*, and obtained a plentiful growth of teleutospores of the type *Uromyces Poæ*. The Æcidium on *R. platanifolius* he found belonged to a type of *Uromyces Dactylidis*: it grew abundantly on *Dactylis glomerata*. An Æcidium on *Caltha palustris* was proved to be an autœcious form *Puccinia Zopfii*.

Ed. Fischer ‖ writes on the influence of Alpine conditions on the development of Uredineæ. There is a large proportion of reduced forms in Alpine regions. Schneider has pointed out the more rapid development of Alpine species than of those found in the plains. Fischer thinks that this effect is due to climate, and fixed by heredity

* Ann. Mycol. iii. (1905) pp. 437–66.
† Centralbl. Bakt., xv. (1905) pp. 227–32.
‡ Tom. cit., pp. 232–4.
§ Tom. cit., pp. 257–8.   ‡ Tom. cit., pp. 258–9.
‖ Arch. Sci. Phys. Nat., xx. (Geneva, 1905) pp. 572–3.

B. Iwanoff conducted experiments on *Puccinia Pimpinellæ* simultaneously at Faulhorn and at Berne. At the latter station uredospores and more particularly teleutospores, were produced more quickly and in larger numbers.

Native or Blackfellow's Bread.*—D. McAlpine gives an historical and descriptive account of this substance, an underground sclerotium, of which the fructification is *Polyporus Mylittæ*. The sclerotium is found in connection with decaying trees; it attains a large size, and may weigh up to 50 lb. It is neither nutritious nor appetising. Hitherto it is recorded only from Australia and Tasmania.

Distribution of Dry-rot in Russia.†—L. V. Lubimoff reports the enormous spread of this disease of wood, especially throughout the railway system. It attacks the wood of which so many of the houses are built, and also carpets, paper, leather, pictures, etc. The author describes the various fungicides that have been employed to kill the fungus, and he gives the formulæ of those that are most effective.

Growth of Fairy Rings.‡—Fr. Thomas has made observations and measurements of a very large ring of *Hydnum suævolens* in a pine wood in Thuringia during nine years and gives various data. In 1896 the radius from centre to circumference measured 8·41 m.; the ring at that date was complete, but was never again seen in such perfection. As nearly as possible, measurements were made on the same radius or at least in the same direction. In 1905 it had reached 10·36 m., an average increase of 22 cm. for each year. Thomas calculates that the ring must have been growing 45 years. During the years it was under observation, *Hydnum suævolens* was never observed growing within the circle.

Parasites of Lime Trees.§—P. Vuillemin writes of the parasitic fungi that infest lime trees, more especially the leaves. *Cercospora microsora*, he finds, is very destructive to the leaves attacked. It enters by the stomata; the fructifications are formed in the epidermis and perforate the cuticle. The development of the fungus is described in detail. *Helminthosporium Tiliæ* is also a harmful parasite; it attacks both leaves and branches. These fungi and others in damaging the leaves interfere with the nutrition of the tree.

Diseases of the Red Beech.‖—J. Tuzson discusses the condition of beech wood and the abnormalities of growth that may occur. He describes the false heart-wood which is due to fungus hyphæ penetrating through a wound to the heart of a tree. It is not yet ascertained which fungus causes the damage. The destruction of the timber is also dealt with. The fungi that are here concerned are more easily identified. He considers *Hypoxylon coccineum* and species of *Stereum* among the

* Journ. Agric. Victoria, 1904, pp. 1012–23 (5 pls.).
† Zeitschr. Oesterr. Ingen. Archit. Ver., 1905, p. 363. See also Centralbl. Bakt., xv. (1905) p. 269–70.
‡ Ber. Deutsch. Bot. Ges., xxiii. (1905) pp. 476–8.
§ Ann. Mycol., iii. (1905) pp. 421–6 (15 figs.).
‖ Berlin: Julius Springer, 1905 (17 figs. and 3 pls.). See also Bot. Centralbl., xcix. (1904) pp. 620–3.

most important; *Tremella faginea*, *Bispora monilioides* and *Schizophyllum commune* also aid in breaking up the wood. Other fungi are responsible for special attacks on the trees or on the timber, and these are described as also the best methods of prevention or cure.

Diseases of Tobacco.*—A. H. Sleby gives an account of the various fungal diseases that attack the tobacco plant. A root rot is caused by *Thielavia basicola*; where it has been noted, the beds should be changed. *Rhizoctonia* also occurs on the roots, and a similar treatment is recommended. Several other leaf diseases are mentioned as occurring or likely to occur.

Diseases of the Vine.†—A disease of vine leaves due to *Phyllosticta bizzozeriana* was noted by Gy de Istvánffi in 1900. It caused brown spots to appear on the leaves, on which appeared later the perithecia of the fungus. As a disease the fungus is not of great importance, and seems to be dying down. He gives a list of 10 species of *Phyllosticta* on vines.

An exhaustive account of the grey-rot of the vine is given by the same author in a further paper.‡ He describes the fungus *Botrytis cinerea* in its effects on the vine and the development in various artificial media. He also recapitulates all that is known of the *Sclerotiniæ* of *Botrytis*, and describes the means that have been taken to stamp out the disease.

Plant Diseases.§—F. Noack gives an account of the lectures dealing with plant diseases, delivered at the International Agricultural Congress at Rome. Montemartini discussed the predisposition of plants to disease and certain advantages some had, such as thickness of epidermis in resisting attack. Voglino gave an account of several fungi that attack rice: species of *Coniothyrium*, *Sphærella* and *Piricularia*. Istvánffi described the damage done to vines by *Ithyphallus impudicus* by destroying the roots. Jaczewski discussed the gooseberry mildew and a disease of cotton caused by *Neocosmospora basinfecta*, and Speschnew gave an account of a mulberry disease due to *Fusarium Schavrovii*, which attacks the twigs and entirely destroys them. A leaf disease was found to be due to *Septoglæum mori*.

Rippert ‖ communicates the results of researches in several fields of plant disease. Two attacks due to bacilli, on potato tubers, and on the stalks of cucumbers are described, and advice given as to dealing with them. Black, yellow, brown, and other rusts are enumerated, with their respective hosts. Streak-disease of barley is due to *Helminthosporium gramineum*, which develops on decaying leaves in the soil and infects

* Bull. Ohio Agric. Exper. Station, clvi. (1905) pp. 87–107. See also Bot. Centralbl., xcix. (1905) p. 548.

† Ann. Inst. Centr. Ampelog. Roy. Hongrois, iii., livr. 3 (1905) pp. 167–82 (1 pl.). See also Hedwigia, xlv. (1906) Beibl., pp. 52–3.

‡ Op. cit., livr. 4, pp. 183–360 (7 pls.). See also Hedwigia, xlv. (1906) Beibl. p. 53.

§ Zeitschr. Pflanzenkr., xv. (1905) pp. 344–5, 356–9.

‖ Fühlings Landw. Zeit., Nos. 14–15 (1905). See also Centralbl. Bakt., xv. (1905) pp. 479–80.

the seedling plants. Oats are also attacked by other forms of *Helminthosporium*.

Gummosis and canker of fruit-trees are due, the latter to wound infections, the former to a variety of causes that are best met by providing more nourishment for the tree.

Köck * describes the injury done to roses by the fungus *Coniothyrium Fuckelii*. It is found on the young shoots. Fungicides are recommended.

An epidemic disease of tomatoes was found by V. Oven † to be caused by a new and variable species, *Fusarium erubescens*. It increases by micro- and macrogonidia, by chlamydospores and by sclerotia, and attacks ripe and unripe fruits, gaining entrance by wounds.

H. Gussow ‡ has examined the disease of cucumbers first reported and described by Cooke and Massee as due to *Cercospora Melonis*. He has decided that the fungus is not a *Cercospora*, and he gives it the name of *Corynespora Mazei* g. et sp. n. He gives reasons why he has not placed it in *Polydesmus*, and why he has given it a new specific name. He also describes the germination of the spores in artificial cultures.

Harold H. Hume § describes an anthracnosis of the Pomelo (bitter orange) the leaves and fruit show brown spots on which the fruits of *Colletotrichum* are developed. The fruit is attacked on the tree or after it is gathered, and the flavour is spoiled.

A disease of potatoes has been determined by G. Lagerheim and G. Wagner to be due to *Cercospora concors*. It causes spots on the leaves, which increase till the greater part of the leaf is destroyed. Description of the fungus is given, and remedies suggested.

Witches' Brooms.‖—E. Heinricher failed to reproduce witches' brooms on cherry-trees by inoculation with spores of the fungus *Exoascus Cerasi*, but he succeeded in grafting a "broom" from a diseased tree to a healthy one.

In a second paper ¶ he describes a very large "broom" on *Prunus Padus*. He was unable to account for its growth, as no trace of the fungus could be detected in the leaves.

Fungus Spores in the Atmosphere.**—K. Saito placed dishes containing nutrient gelatin in many localities to test the presence of floating fungus spores. He found that they varied considerably according to the weather—wind, rain or temperature. In the heat of summer, *Botrytis cinerea* and *Verticillium glaucum* appeared most frequently; in colder weather species of *Heterobotrys* and *Fusarium roseum*. At average times the most frequent were *Penicillium glaucum*, *Cladosporium*

* Zeitschr. Land. Versuch. Oesterr., 1905, heft 7. See also Centralbl. Bakt., xv. (1905) pp. 489–90.

† Land. Jahrb., 1905, heft 3–4. See also Centralbl. Bakt., xv. (1905) pp. 491–2.

‡ Zeitschr. Pflanzenkr., xvi. (1906) pp. 10–13 (5 figs.).

§ Bull. Florida Agric. Exper. Station, No. 74, Jacksonville, 1904 (4 pls.). See also Zeitschr. Pflanzenkr., xvi. (1906) pp. 52–3.

‖ Nat. Zeit. Land. Forstw., iii. (1905) pp. 334–8. See also Ann. Mycol., iii. (1905) p. 483.

¶ Tom. cit., p. 348. See also Ann. Mycol., iii. (1905) p. 483.

** Journ. Coll. Sci. Tokyo, xiii. (1904) pp. 1–53. See also Centralbl. Bakt., xv. (1905) p. 266.

herbarum, species of *Epicoccum*, *Aspergillus*, *Catenularia*, *Mucor*, *Rhizopus*, *Macrosporium* and *Monilia*. Saito found that there was remarkably little difference in spore contents between the air of hospitals, gardens, and laboratories.

Wounds and Gummosis in the Amygdalæ.*—M. W. Beijerinck and A. Rant have studied the question of the origin of gummosis in trees, both by observation and experiment. They chose peach and almond trees as most suitable for their purposes; the parasitic fungus to which gummosis on these trees is attributed is *Coryneum Beijerinckii*. The authors studied the tissue changes that take place in the tree in consequence of infection by the fungus, and the physiological conditions that result in the formation of gum. They find that in certain cells where the protoplasm has been killed the enzymes remain active ("necrobiosis") and produce gum in great abundance. All agents that induce the condition of necrobiosis increase gum production. There are various kinds of fungi that gain entrance by wounds in the trees. The authors consider that this might be of economical advantage, and that artificial gummosis might be induced by infection with a suitable fungus such as *Coryneum*.

Poisoning by Fungi.†—J. Hockauf has investigated a supposed case of poisoning by *Helvella*. He tested both *Morchella* and *Helvella* by supplying them to animals. The brains of the animals were then examined, with constantly negative results. The author considers that the conditions of growth of the fungi must have considerable influence in the production of poisonous qualities. *Helvella* he considers to be always rather dangerous as an edible. It is not allowed in the markets of Austria; it is, however, sold in Munich.

ANONYMOUS—**Ueber die Getreideroste, unter besonderer Berücksichtigung ihres auftretens im jahre 1904.** (On rusts of cereals, with special consideration of their appearance in the year 1904.)
Kgl. Agrik. bot. Anst. München. (Practical leaflets for plant growth and plant protection, iii. (1905) heft 5–7.). See also *Centralbl. Bakt.*, xv. (1905) pp. 483–4.

ARTHUR, J. C.—**Amphispores of the Grass and Sedge Rusts.**
Proc. Indiana Acad. Sci., 1904, p. 64.

BACCARINI, P.—**I Funghi dello Schen-si settentrionale raccolti dal Padre Giuseppe Giraldi.** (The fungi of the Northern Schen-si, collected by Father Giuseppe Giraldi.)
[The list includes large and small forms of fungi. Two new species are described.] *Nuovo Giorn. Bot. Ital.*, xii. (1905) pp. 689–98.

BEARDSLEE, H. C.—**The Amanitas of Sweden.**
[Notes on species observed by the author, and compared with American species.] *Journ. Mycol.*, xi. (1905) pp. 212–16.

BERGAMESCO, G.—**Basidiomicete ed Ascomicete.**
[A list of 51 species of the larger fungi, collected by the author in the wood of the Camaldoli, near Naples, in the spring of 1905.]
Nuovo Giorn. Bot. Ital., xii. (1905) pp. 652–6.

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* Centralbl. Bakt., xv. (1905) pp. 366–75.
† Wiener Klin. Wochenschr., xviii., No. 41 (1905) 8 pp. See also Bot. Centralbl. ci. (1906) p. 103.

BOKORNY, TH.—**Ueber das Aufsammlungsvermögen der Hefe für Farbstoffe und gewisse Schwermetallsalze.** (On the coloration of yeast and attraction of heavy metal salts by yeast-cells.) *Alg. Brauer. Hopf. Zeitung*, No. 193 (1905) p. 2101. See also *Centralbl. Bakt.*, xv. (1905) pp. 471–2.

BRIZI, V.—**Sul Brusone.** (On Brusone.)
[A disease of the roots of rice, probably due to *Piricularia oryzæ*.]
Agricultura Moderna, xi. (1905) pp. 380–94, 452. See also *Centralbl. Bakt.*, xv. (1905) pp. 653–4.

BUSSE, WALTER—**Untersuchungen über die Krankheiten der Sorghum-Hirse.** (Research on the diseases of *Sorghum*.)
[The writer includes several fungi in his survey: smuts, rusts, and moulds.]
Arb. Biol. Abt. Land. Forstw. k. Ges. Amte, iv. (1904) p. 319 (2 pls. and 12 figs.). See also *Zeitschr. Pflanzenkr.*, xv. (1905) pp. 335–7.

DIETEL, P.—**Uredineæ japonicæ. VI.**
[Many new species are described.]
Engler's Bot. Jahrb., xxxvii. (1905) pp. 97–109. See also *Bot. Centralbl.*, xcix. (1905) p. 547.

DOP, P.—**Sur la biologie des Saprolegniées.** (On the biology of the Saprolegniæ.)
[Records the culture of *Saprolegnia Thureti*.]
Comptes Rendus, cxl. (1905) pp. 454–5. See also *Centralbl. Bakt.*, xv. (1905) pp. 268–9.

EICHLER, B.—**Didymosphæria Marchantiæ Starb.**
[Description of a species of fungus hitherto recorded only from Sweden.]
Bot. Notiser, 1898 (*Wszechświat* [*Weltall*] *Warsaw*, xxiv. (1905) No. 22, p. 348. Polish). See also *Bot. Centralbl.*, xcix. (1905) p. 567.

HANSEN, EMIL CHR.—**Oberhefe und unterhefe studien über Variation und Erblichkeit.** (Studies on variation and heredity in yeasts.)
Centralbl. Bakt., xv. (1905) pp. 353–61.

HARIOT, P., & N. PATOUILLARD—**Sur un nouveau genre de Champignons de l'Afrique orientale anglaise.** (A new genus of fungi from English East Africa.)
[The new genus *Colletomanginia* is one of the Hypocreaceæ section Melanosporæ.] *Comptes Rendus*, cxlii. (1906) pp. 224–6.

HÖHNEL, FRANZ v.—**Mycologische Fragmente.**
[Descriptions of several new species, and critical notes on others already recorded.] *Ann. Mycol.*, iii. (1905) pp. 402–9 (4 figs.).

HOLLWAY, E. W. D.—**North American Uredineæ.**
Vol i. part 1. See also *Ann. Mycol.*, iii. (1905) p. 479.

HOLLÓS, L.—**Ueber die Trennung der Ungarischen Scleroderma-Arten.** (On the division of species of Hungarian Sclerodermæ.)
[Careful descriptions of four different species.]
Math. Nat. Wiss. Ber. Ungarn, xx. (1905) pp. 312–14.

„ „ **Beiträge zur Kenntnis der Pilzflora im Kaukasus.** (Contributions to the knowledge of the fungus flora of the Caucasus.)
[162 species are recorded, including 14 Mycetozoa, with one new species, *Trichia ovalispora*.]
Tom. cit., pp. 315–25.

„ „ **Peteromyces loculatus Müll. in Herb.**
[Criticism of an Australian genus, named by Cooke and Massee *Diploderma glaucum*.] *Tom. cit.*, pp. 326–7 (2 figs.).

JAAP, OTTO—**Beiträge zur Pilzflora von Mecklenburg.** (Contributions to the fungus flora of Mecklenburg.)
[The fungi were collected in the neighbourhood of Warnemunde.] *Ann. Mycol.*, iii. (1905) pp. 391–401.

JAAP, OTTO—**Fungi selecti exsiccati.** (Series vi. Nos. 126–50.)
[Fungi from Brandenburg, Schleswig-Holstein, Denmark, and Switzerland, are included; several new species are recorded.] Hamburg, November 1905. See also *Bot. Centralbl.*, ci. (1906) p. 104.

KÖCK, G.—**Septoria Lycopersici auf Paradiespflanzen und Phyllosticta Cyclaminis auf Cyclamen persicum.** (*Septoria Lycopersici* on tomatoes, and *Phylosticta Cyclaminis* on *Cyclamen persicum*.)
[Description of two leaf diseases.]
Zeitschr. Landw. Ver. Oesterr., 1905, p. 572. See also *Centralbl. Bakt.*, xv. (1905) pp. 271–2.

KULISCH—**Ueber das diesjahrige Auftreten der Peronospora am Rebstocke besonders auf den Trauben.** (On the occurrence of *Peronospora* on the vine, and especially on the grapes, during the current year.)
Nat. Zeitschr. Land. Forstw, 1905, heft 9. See also *Centralbl. Bakt.*, xv. (1905) pp. 655–6.

LAUBERT, R.—**Die Kropfkrankheit (Plasmodiophora) des Kohls und ihre Bekämpfung.** ("Finger and toe" on turnips, and methods of prevention.)
Praktische Blätter für Pflanzenbau und Pflanzenschutz, iii. (1905) heft 7, pp. 78–9. See also *Centralbl. Bakt.*, xv. (1905) pp. 652–3.

LIND, J.—**Ueber einige neue und bekannte Pilze.** (On some new and previously known fungi.) *Ann. Mycol.*, iii. (1905) pp. 427–32 (1 fig.).

MAGNUS, P.—**Notwendige Umänderung des Namens der Pilzgattung Marssonia Fisch.** (Necessary change of the name of the fungus genus *Marssonia* Fisch.)
[As the name *Marssonia* had already been used for a genus of Phanerogams, Magnus changes the name to *Marssonina* P. Magn.]
Hedwigia, xlv. (1906) pp. 88–99.

MORGAN, A. P.—**North American species of Marasmius.**
Journ. Mycol., xi. (1905) pp. 201–12.

MURRILL, W. A.—**The Polyporaceæ of North America. The described species of Bjerkandera, Trametes, and Coriolus.** *Bull. Torrey Bot. Club*, xxxii. (1905) pp. 633–56.

REHM—**Ascomyceten exs. Fasc. 35.**
[Notes and descriptions of 25 species.]
Ann. Mycol., iii. (1905) pp. 409–17.

SAVOURÉ, PIERRE—**Recherches expérimentales sur les mycoses internes et leurs parasites.** (Experimental researches on internal mycoses and their parasites.)
[These are species of *Mucor*, *Rhizopus*, and *Aspergillus*.]
Arch. Parasit., x. (1905) pp. 5–70 (20 figs.). See also *Bot. Centralbl.*, ci. (1906) pp. 11–12.

SIGMUND, WILHELM—**Beiträge zur Kenntnis des Wurzelbrandes der Rube.** (Contributions to our knowledge of root disease of the beet.)
[A study of the effect of *Phoma* and *Bacillus mycoides* on the roots.]
Naturw. Zeitschr. Land. Forstw., iii. (1905) pp. 212–21. See also *Centralbl. Bakt.*, xv. (1905) pp. 273–4.

STIFT, A.—**Bemerkungen über den Gürtelschorf der Ruben.** (Remarks on the girdle scab of beet.)
[The writer discusses Krüger's statement that scab was caused by *Oospora*.]
Wiener Landw. Zeitung, 1905, p. 712. See also *Centralbl. Bakt.*, xv. (1905) p. 654.

STRASZER, P. PIUS—**Dritter Nachtrag zur Pilzflora des Sonntagberges (N.Ö.), 1904.** (Third contribution to the fungus flora of Sonntagberg.)
[Species 857–1088 are recorded, many of them with full diagnoses. There are several new species described by Bresadola.]
Verh. k. k. Zool. Bot. Ges. Wien, lv. (1905) pp. 600–21.

SYDOW—**Mycotheca germanica.** (Fasc. viii.-ix. Nos. 351–450.)
[A list of the species is given, and notes on several species; one only is new.]
Ann. Mycol., iii. (1905) pp. 418–21.

THAXTER, ROLAND—**Preliminary Diagnoses of new species of Laboulbeniaceæ. VI.**
Proc. Amer. Acad. Arts and Sci., xli. (1905) pp. 303–18.
See also *Bot. Centralbl.*, xcix. (1905) pp. 548–9.

UZEL, H.—**Mitteilung über Krankheiten und Feinde der Zuckerrübe in Böhmen im Jahre 1904.** (Contributions on the diseases and enemies of sugar-beet in Bohemia in the year 1904.)
[They are mostly insects that are dealt with. *Rhizoctonia violacea* was the principal fungus disease.]
Zeitschr. Zuckerind. Böhmen, xxix. (1905) p. 399.
See also *Centralbl. Bakt.*, xv. (1905) pp. 272–3.

VELLER—**Zum Auftreten der Peronospora viticola im heurigen Jahre.** (The occurrence of *Peronospora viticola* in the current year.)
Oesterr. Landw. Wochenbl., 1905, No. 32.
See also *Centralbl. Bakt.*, xv. (1905) p. 655.

VIALA & PACOTTET—**Nouvelles recherches sur l'anthracnose.** (New researches on anthracnosis.)
[An account of yeasts, etc., that cause the disease.]
Revue de Viticulture, xxiv. (1905) 65 pp., 7 pls. and 85 figs.
See also *Bot. Centralbl.*, ci. (1906) pp. 13–15.

WEHMER, C.—**Versuche über Mucorineengärung. II.** (Research on mucor fermentation.)
[The mucor experimented with was *M. javanicus*.]
Centralbl. Bakt., xv. (1905) pp. 8–19.

WHITE, E. A.—**A Preliminary Report on the Hymeniales of Connecticut.**
[The paper gives keys to the genera and families, and a list of species.]
Bull. Conn. State Geol. Nat. Hist. Survey, iii. (1905) pp. 1–81 (40 pls.). See also *Bot. Centralbl.*, xcix. (1905) p. 549.

WIZE, C.—**Die durch Pilze hervorgerufene Krankheiten des Rübenrusselkäfers (Cleonus punctiventris) mit besonderer Berucksichtigung neuer Arten.** (Disease of the turnip weevil (*Cleonus punctiventris*) caused by fungi, with special consideration of new species.) Polish.
[A considerable number of fungi attack the weevil; three are described.]
Bull. Int. Acad. Sci. Cracovie, 1904, No. 10, pp. 713–26 (1 pl. and 11 figs.). See also *Bot. Centralbl.*, xcix. (1905) p. 624.

Lichens.

(By A. LORRAIN SMITH.)

New Lichen Genus.*—A. Jatta has found among the lichens collected in Chili by G. F. Scott Elliot a new form with a very sparse lichen thallus somewhat resembling the thallus of a *Cœnogonium*. He considers it to be the type of a new genus, *Amphiloniopsis*. The apothecia are lecanorine, of a beautiful orange colour; the spores are fusiform, three-septate. The fungus grew on the spines of *Cereus peruvianus*. Jatta places this genus along with *Amphiloma* and *Leproloma* in the tribe Amphilomei.

French Lichens.†—Bouly de Lesdain has collected lichens during July and September for three years in succession in the neighbourhood

* Nuovo Giorn. Bot. Ital,, xii. (1905) pp. 482–7 (6 figs.).
† Bull. Soc. Bot. France, v. (1905) pp. 602–28.

of Versailles, and he now publishes a list of the species he has found. The tree forms are particularly well represented. In many cases the author gives a complete description of the species; nearly always he gives the chemical reactions. There are 188 species and 48 forms or varieties recorded.

Research on Silicious Lichens.*—E. Stahlecker considers that the form and anatomy of the lichen thallus are influenced by the chemical constitution. On rocks composed of various constituents, the anatomical form of the plant is modified so that the hyphal layer in comparison with the gonidial layer is stronger, especially where there is a larger proportion of basic substance present, as for instance of lime. On stratified rocks the silicious lichens grow most readily on the face of the stone, at right angles to the strata. Fresh surfaces are favourite localities, while weathered surfaces are avoided. The more acid the substratum and the drier the fungus, the larger are the separate gonidia. If the hyphæ are stronger, then the gonidia are weaker. Lichens are not found alone on the rocks, and therefore other factors influence their development.

Chemistry of Lichens.†—W. Zopf publishes a further contribution on this subject. In *Sphærophorus* collected from granite he had found sphærophorin, sphærophoric acid, and fragilin. Another collection of the same lichen from gneiss has enabled him to verify his previous findings, and to describe more definitely the properties of the new substances. From the thallus of *Biatora mollis*, collected on sandstone, he has isolated diffusin acid, a substance similar to that which he found in *Platysma diffusum*. A section of *Gyrophora polyrrhiza* becomes red on the application of calcium chloride. Zopf finds that this is due to the presence of lecanoric acid. He found, in addition, two other substances, umbilicar acid and gyrophor acid. He examined several other lichens, and gives an account of the chemical constituents, and of their colour reactions.

JAAP, O.—**Einige Neuheiten für die Flechtenflora Hamburgs.** (Some new records, from the lichen flora of Hamburg.)
Allgem. Bot. Zeitschr., vi. (1905) pp. 150–1.
See also *Bot. Centralbl.*, xcix. (1905) p. 549.

KOVAR, F.—**Beitrag zur Flechtenflora der Umgebung Saars in Mähren.** (Contribution to the lichen flora of the neighbourhood of Saars, in Mähren.) Russian.
S.A. Vestnik Klubu prirod. v. Prost. za rok, 1906 (1905) 8vo, 16 pp. See also *Bot. Centralbl.*, ci. (1906) p. 73.

WAINIO, E.—**Lichenes expeditionis G. Amdrup (1898–1902).**
[A contribution to our knowledge of Arctic lichens.]
Meddel. om. Grönland, xxx. (1905) pp. 125–41.
See also *Ann. Mycol.*, iii. (1905) pp. 489–90.

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* Inaug. Dissert. Stuttgart, 1905, 8vo, 44 pp., 1 pl. See also Ann. Mycol., iii. (1905) p. 489.

† Liebig's Ann. Chemie, cccxl. (1905) pp. 276–309. See also Bot. Centralbl., xcix. (1905) pp. 588-9.

Schizophyta.

Schizomycetes.

Oligonitrophil and Mesonitrophil Bacteria.*—R. Perotti, adopting the method employed by Beijerinck for the bacteriological analyses of soils, has examined the soil of the Roman Campagna with especial reference to the oligonitrophil and mesonitrophil bacteria—that is, those organisms that can develop in media entirely free from or only containing a limited amount of nitrogen. From his results he is led to consider the connection of these organisms with the value of fallow land in the practice of rotation of crops, and believes that this last has a biological explanation, and depends on the organisms found in the soil.

Bacteriology of Armenian "Mazun."†—M. Düggeli, from the results of his researches on the bacteriology of Armenian "Mazun," a highly estimated form of fermented milk, concludes that three different kinds of micro-organisms are to be met with, viz. yeasts, long rods of lactic acid-forming bacteria, and organisms resembling *B. guntheri* L. and N. The yeasts that were isolated fermented lactose, with the formation of acid, alcohol, and aromatics; the lactic acid bacteria gave with lactose an abundant production of acid. Biologically, "Mazun" is allied to "Kefir," "Sauersteig," "Käsereisauer," etc., in all of which there is an association of yeasts and strong lactic acid-producing organisms; though it is not possible to assign the specific agent in the production of "Mazun," it appears that this association of organisms is not of the nature of a symbiosis.

Capsulated Bacilli.‡—E. Bertarelli classifies the capsulated bacilli into two main divisions, each comprising several sub-groups, according to their biochemical actions on the different sugars, and the agglutinating reactions they produce with immune sera.

Action of Micro-organisms on the Solution of Blue Azur in Methyl Alcohol.§—M. F. Marino, after discussing the constitutions of eosin-methylen-blue solutions, finds that when placed in broth-cultures of certain micro-organisms these solutions are dissociated. On to the surface of a broth-culture of *B. anthracis* some eosin-methylen-blue solution is poured in such a manner as not to mix with the liquid; a control tube of uninoculated broth is similarly treated. The two tubes are left at the temperature of the laboratory. After five minutes the coloured layer in contact with the culture has changed, a pink zone appearing above the culture liquid, and after several hours showing as a pink ring surmounted by a layer of blue. The blue in contact with the living microbe has been reduced, and so allows the eosin to become visible. In the control tube no change has occurred. This effect, which has been observed in a number of different cultures, is most marked when the culture is most active and abundant. The reaction

* Atti R. Accad. Lincei, xiv. (1905) p. 623.
† Centralbl. Bakt., 2te Abt., xv. (1905) p. 577.
‡ Op. cit., Ref. 1te Abt., xxxvii. (1005) p. 333.
§ Ann. Inst. Pasteur, xix. (1905) p. 816.

serves to distinguish various strains of bacteria that do not grow with the same activity, and to detect the increased or diminished vitality of cultures, and it also allows one to estimate the value of different media; the energy of the reduction is measured by the depth of the pink zone. The rapidity of the reduction is not proportionate to the pathogenic virulence of the organism, but depends on the number of the organisms present. The reaction is favoured by a temperature of 35° C. The author suggests that this reaction might be useful in detecting the presence of microbes in liquids in which on microscopic examination their presence could not be detected.

New Chromogenic Slime-producing Organism.*—F. C. Harrison and B. Barlow isolated from oily butter a chromogenic microbe that formed slime and crystals, and to which they gave the name *B. viscofucatus*. The organism is a non-motile rod, $1 \cdot 0\ \mu$–$1 \cdot 8\ \mu$ long by $0 \cdot 6\ \mu$–$0 \cdot 9\ \mu$ broad, occurring singly or in chains, with a tendency to pleomorphism; after the formation of slime a capsule was observed; no spore formation was noted; it stains by ordinary dyes and by Gram's method. On gelatin plates to which various carbohydrates were added, the colonies after five days were 1 mm. in diameter, and liquefaction had commenced; the colonies were slimy, and much pigment had developed, showing blue or violet with sucrose, dextrose, mannite, and maltose, and green with galactose, dextrin, and starch; gelatin without carbohydrates developed only a yellow-green tint. On agar it formed white slimy colonies, but no pigment; on 1–20 p.c. sucrose agar there was a deep blue pigmentation. In milk, after 25–40 hours at 18°–22° C., there appears a grey-blue coloration, which becomes bright blue and later disappears; there is much slime produced, and late peptonisation of the medium. On potato at 22° C. it forms a yellowish-white slimy growth, the medium becoming a bright dark-blue after 4–5 days, and later becoming ochre-yellow or rust colour. The pigment was extracted from an agar culture in 50 p.c. alcohol, the solution being blue to wine colour; it was soluble in water, but not in benzin or chloroform. The slime after separation was soluble in cold water, and after heating with dilute acid it reduced Fehling's solution.

Bacteria that obtain their Carbon from Methan†.—N. L. Söhngen has demonstrated that the absorption of methan by plant life is due to a micro-organism. By means of an arrangement of two Erlenmeyer flasks, and a special carbon-free fluid medium (which he inoculated with slop-water or grave-water, and to which he admitted a known mixture of oxygen and methan, the whole being placed at 30°–37° C.) he obtained after 2–4 days a pellicle growth; on analysing the gaseous mixture when the culture was a week old, he found that the methan had entirely or partly disappeared, whereas an appreciable amount of CO_2 had been produced. The bacterial pellicle was composed chiefly of one variety of bacterium: short stout rods, motile only in young cultures, provided with one flagellum. This organism the author has named *B. methanicus*; by growing this bacterium in his apparatus he was able to show that methan was the only source from which it could obtain carbon.

* Centralbl. Bakt., 2te Abt., xv. (1905) p. 517. † Tom. cit., p. 513.

Bacilli growing on Drigalski-Conradi Nutrient Agar.*—J. Th. Terburgh obtained from the analysis of canal and other waters in Amsterdam, 61 pure cultures of organisms grown on Drigalski-Conradi plates. Of these 18 were red colonies, 16 showing cultural relationship to the *Coli* group, but exhibiting many variations, and 2 being gelatin liquefiers were assigned to the *Proteus* group. The remaining 43 cultures had blue colonies; of these, 2 showed a faint red coloration round the blue, and belonged to the spirilla, but did not liquefy gelatin; 9 colonies showed coccal forms; 15 belonged to four groups—*B. pyocyaneus* (2), *B. fluorescens* liq. (4), *B. fluorescens* non-liq. (6), and *B. proteus vulgaris* (3), so that this last group was represented in both the red and the blue colonies. The organisms of 3 colonies resembled those of *B. typhosus*, but could be differentiated both from this and from the *B. paratyphosus* by their agglutinating reactions. The remaining 14 cultures showed many varieties.

Bacterium Agreste.†—F. Löhnis has isolated from agricultural soil on mannite-soil-agar cultivations, a nitrogen-fixing organism morphologically resembling *B. pestis*, but which is non-pathogenic and possesses active motility. He has named this organism *B. agreste*. The colonies appeared after 1–2 days at 30° C., as light grey transparent circular or oval drops, of 6 mm. diameter, composed of round-ended rods $\frac{3}{4}\mu$ broad by 1μ–2μ long; they stain by the ordinary dyes, but not by Gram's method, and often show polar staining; they rarely form threads or chains; they are actively motile and have peritrichous flagella; room temperature is more favourable to growth than a temperature of 37° C.; gelatin is not liquefied; milk is unchanged, but, on shaking, it appears slimy and thready; on potato it forms a white to yellowish-white growth; indol production was noted; glucose and lactose were not fermented; in glycerin-saltpetre-soil extract the nitrogen of the saltpetre is fixed in organic form within six days; no pathogenic action could be observed.

Actinomycetes.‡—E. Haass reviews the position and subclassification of this group of organisms, and refers to the classing according to source, cultural characters, microscopical appearances, the resistance to heat, the presence or absence of pathogenic properties; he refers also to their relationship to the true bacilli, to *B. tuberculosis* and *B. diphtheriæ* on the one hand, and on the other to the moulds; he concludes that the family of the Actinomycetes stands between the Schizomycetes and the Hyphomycetes.

Bacteriology of Measles.§—Ag. Borini examined the blood, and bronchial and conjunctival secretions of children affected with measles. From blood cultures was obtained a small slender bacillus; in glycerin-agar and on defibrinated blood it formed punctiform, transparent, greyish-white colonies. It did not coagulate milk or form CO_2 or indol. When cultures were injected into animals these died in 3–6 days, with pneumonia or pleurisy.

* Centralbl. Bakt., Orig. 1te Abt., xl. (1905) p. 258.
† Tom. cit., p. 177. ‡ Tom. cit., p. 180.
§ Riforma Med., June 24, 1905. See also Centralbl. Bakt., 1te Abt. Orig., xl. (1905) pp. 194–7 (1 pl.).

S. J. Zlatogoroff * cultivated from the blood of measles patients a bacillus 0·4–0·7μ long and from 0·2–0·4μ broad. It is stainable by the usual anilin dyes and also by Gram's method. It is but little motile and occurs in pairs and irregular groups. The ends of the rodlets are rounded and stain more deeply than the central parts. In liquid media it forms a flocculent deposit, the supernatant fluid remaining clear. It grows best at incubation temperature, is aerobic, and does not form spores. It soon dies out, and does not cultivate well in solid media.

New Acetic Acid-forming Bacterium.†—F. Fuhrmann describes a new organism, the *Acetobacter plicatum*, which converts ethyl-alcohol into acetic acid, and which he obtained from one of the vats in wine experiments.

In wine gelatin at 22° C. it forms almost circular, raised colonies of a light yellow glittering colour. It is non-liquefying, and grows in the depths of the medium as spherical colonies, which spread upwards and reach the surface, where typical characteristic growths occur.

In neutral gelatin broth it grows well, but is best seen in stab cultures as concentrically arranged circular opacities 1 c.cm. below the surface, and deeper still as small punctiform colonies. Films stained with methylen-blue show rods 1·4 to 1·6 μ by 0·4–0·6 μ, which from alcohol-free gelatin stain a homogeneous blue, but on wine-gelatin show bipolar staining with an almost unstained centre. On a wine or bouillon-gelatin slope, there appears a fused, delicate, whitish-yellow growth, with finer growths running transversely to the streak.

On beer-gelatin, growth is similar but more slimy, and after a time the culture reddens. On "alcohol-free" beer-gelatin it grows only if neutral or acid, but on alcoholic beer-gelatin strongly alkaline with caustic soda, acid formation occurs, and the culture clears. On bouillon and beer-agar slopes there is a thick, light yellow, opaque growth. Stained films from agar cultures at 28°–30° C. show rods 0·75 μ by 0·6 μ, mostly with a capsule which does not stain with iodine or give the cellulose reaction. Only a sparse growth occurs on potato. In sterile wine containing 3·5 p.c. alcohol, a network forms in the depth and radiates to the surface, forming there a whitish-grey tenacious mould 8–10 mm. thick, and fluid remains clear; the mould gives no starch or cellulose reaction.

The zooglœa structure differs on "alcohol-free" beer and wine.

On "alcohol-free" beer, cane or grape sugar favours the mould growth, but on alcoholic beer grape sugar is unfavourable. At a high temperature only slight changes occurred. At 40° C. some threads were 50 μ long, but not branching, and a low temperature gave only slight evidence of degeneration into short rods, though some staining peculiarities resulted. Sometimes pale blue staining rods, with the wall bulged by a clear space surrounded by a dark blue staining border, favoured the idea of spore formation.

Acetobacter plicatum thrives in wine with 11 p.c. alcohol, and beer containing 9·5 p.c. if the temperature is between 22° and 25° C. Generally speaking, a lower temperature is necessary in wine and beer containing

* Centralbl. Bakt., 1te Abt. Orig., xxxvii. (1905) pp. 249-51.
† Op. cit., 2te Abt., xv. (1905) No. 12.

much alcohol, whilst in media poor in alcohol a higher temperature is better.

Bacillus aureus fœtidus.*—M. Herzog describes a new pathogenic bacterium which was isolated from the liver and heart-blood. The microbe is a bacillus 0·6–2 μ long, and from 0·5–0·8 μ thick; often in pairs, capsulated, non-motile, easily stainable, but not by Gram's method. It liquefies gelatin, forms a golden-yellow pigment. The colonies on solid media are yellow, round, and smooth. It coagulates milk. All cultures, aerobic and anaerobic, exhale a fœtid cheesy odour; they are killed by heating for 10 minutes to 62°.

* Zeitschr. f. Hygiene u. Infekt., xlix. (1905) p. 356.

MICROSCOPY.

A. Instruments, Accessories, &c.*

(1) Stands.

Watson and Sons' Club Microscope.†—In appearance this instrument (fig. 25) is very similar to the Van Heurck model manufactured by Watson and Sons, but the idea has been to simplify the general details, and to provide in it such mechanical conveniences as are desired by an amateur, omitting the refinements that are only required by and of importance to the expert and critical worker.

The tripod foot has a spread of 9 in.; the stage is 5 in. in diameter, and has mechanical and rotary movements; the substage has rackwork to focus and screws to centre, and can be turned aside from the optic axis with the apparatus contained in it when desired. The instrument is of full size, measuring in height 12⅞ in. when racked down.

Watson and Sons' Praxis Petrological Microscope.‡—This is a Petrological Microscope (fig. 26) of continental model, with the horseshoe foot and the upright pillar cast in a solid piece. The body contains an analyser prism and a Klein's quartz plate. The polariser, which is carried in a plate beneath the stage, can be turned aside from the optic axis when desired. The coarse-adjustment is by diagonal rack-and-pinion, and the fine-adjustment is Watsons' standard lever pattern.

Watson and Sons' School Microscope, 1905 Model.§—Severa modifications have been made in this instrument (fig. 27). The foo and the upright are cast in one solid piece, also the stage and the liml are cast solid. The stage has been fitted with an ebonite covering, an although the instrument is made with a coarse-adjustment by diagona rack-and-pinion only, provision has been made for the subsequen addition of fine-adjustment should it be desired.

Reichert's New Large Mineralogical Stand.‖—This instrumer (fig. 28) differs from the one described in the Journal, 1905, p. 245, i that the limb is altered to the handle form, and the fine-adjustmer located therein for greater security.

* This subdivision contains (1) Stands; (2) Eye-pieces and Objectives; (: Illuminating and other Apparatus; (4) Photomicrography; (5) Microscopic Optics and Manipulation; (6) Miscellaneous.

† W. Watson and Sons' Catalogue, 1906, p. 36.

‡ Tom. cit., p. 84. § Tom. cit., p. 68.

‖ Reichert's Special Catalogue, 1905–1906, p. 11.

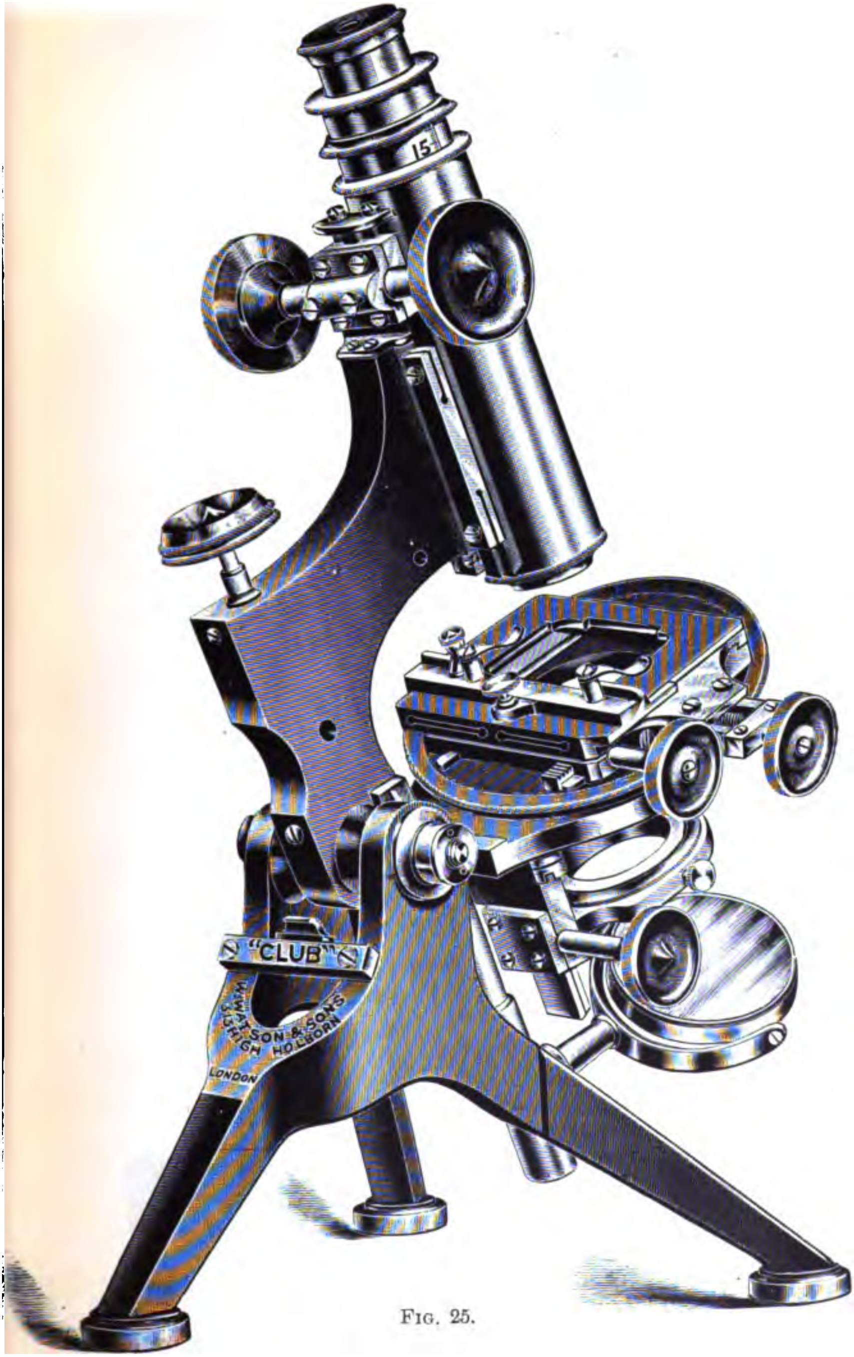


FIG. 25.

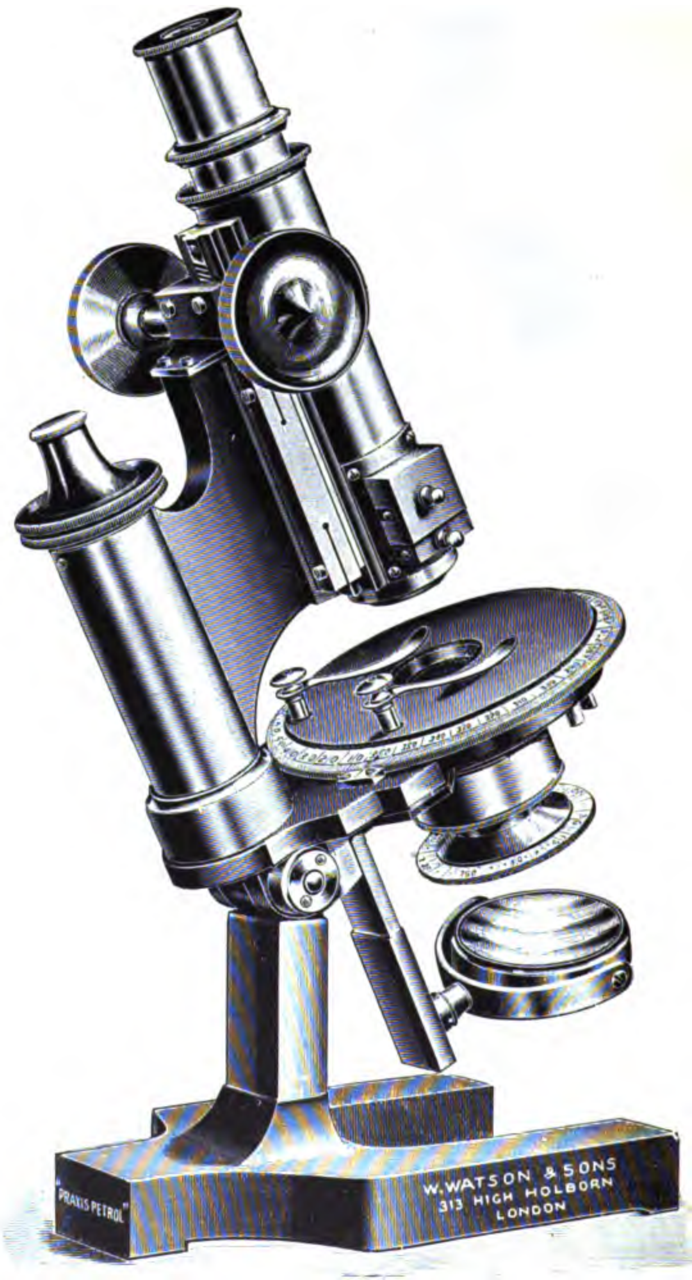


Fig. 26.

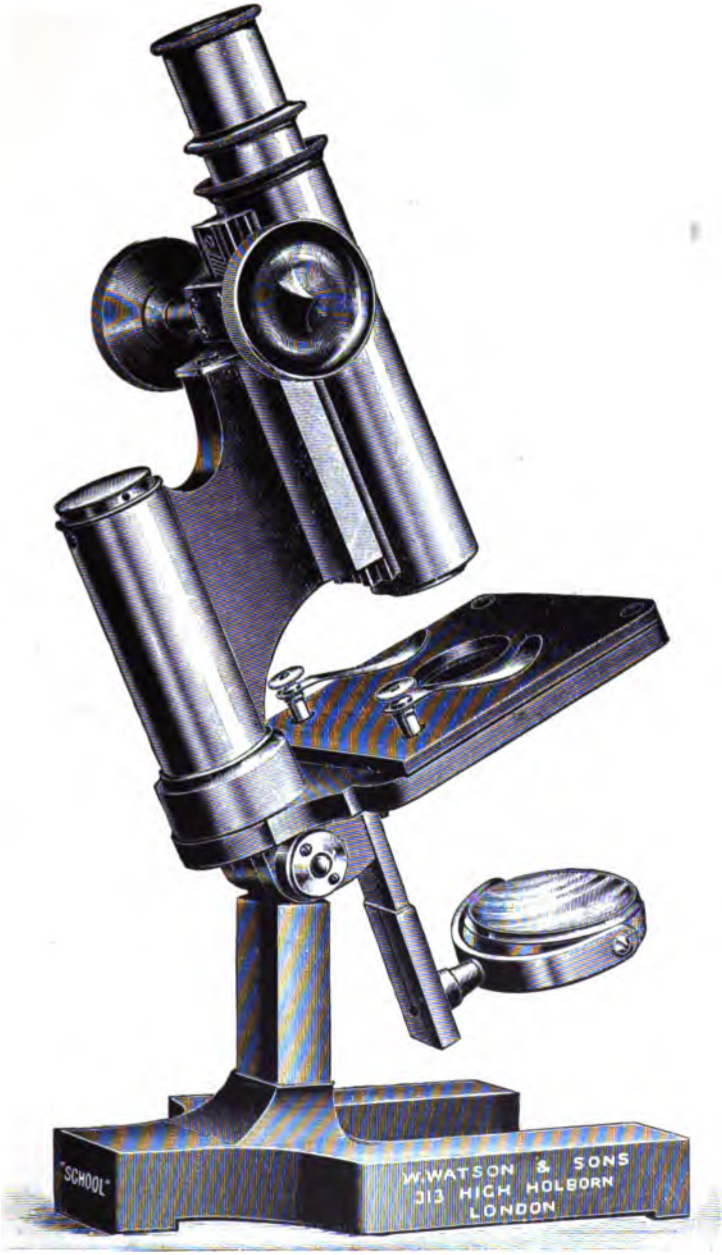


FIG. 27.

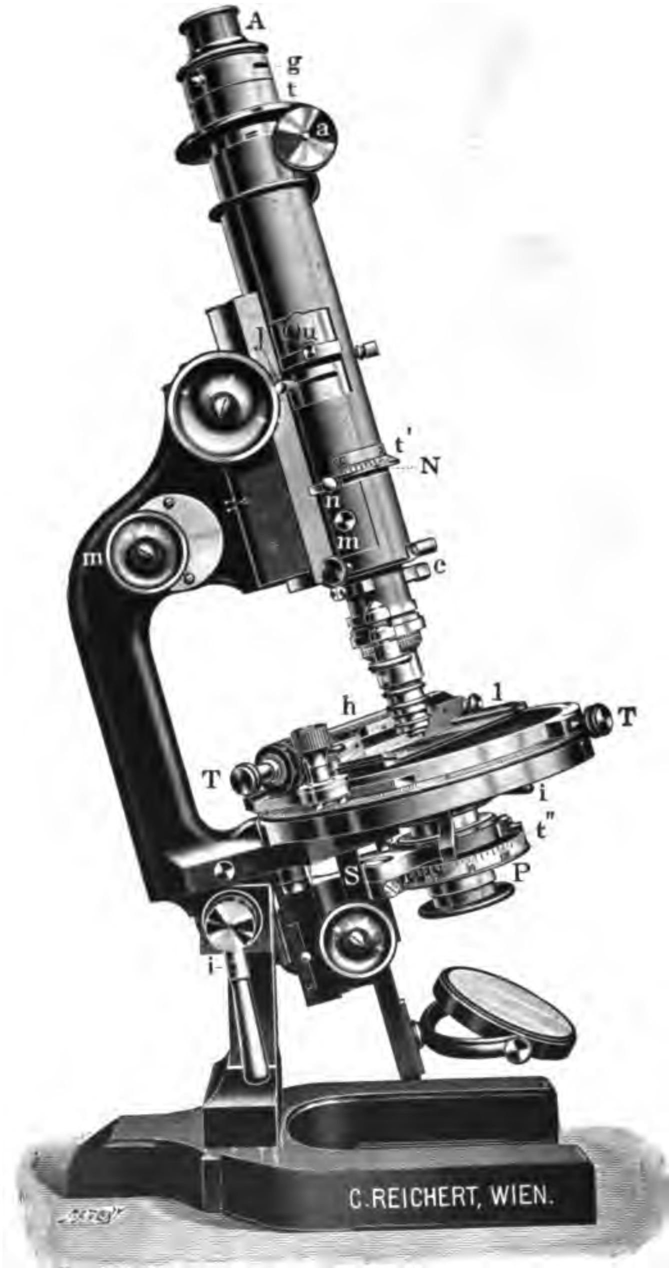


FIG. 28.

(2) Eye-pieces and Objectives.

Dry and Water Immersion 1/8 Objective by Ross.—At the February Meeting R. G. Hebb exhibited an old lens, the property of the Westminster Hospital (fig. 29). Mr. E. M. Nelson kindly examined the objective, and reports as follows:—

This 1/8 is an example of a lens made by Ross upon a formula by Mr. Wenham.

In June 1871, Mr. Tolles, of America, made a 1/8 which could be adjusted by means of its screw collar for either wet or dry use, and Mr. Woodward said that this lens would resolve *Amphipleura pellucida*.

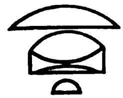


FIG. 29.

When this report was received in England it made a great stir, and opticians were most anxious to equal, if not excel, this result. Hence the origin of the lens.

It is of a peculiar construction, having a single front and back, and a triple middle. This triple has a central biconcave dense flint lens which corrects the aberration of the entire lens. The plan of this lens is figured on the right-hand half of fig. 6 on page 163 of the "Monthly Microscopical Journal," vol. ix., 1873, which appears to be an abstract of the Proceedings of the Royal Society, 1873, No. 141.

The present example differs slightly from the figure inasmuch as it has its back lens turned round the other way, so that its flat side is next the object.

These lenses did not prove successful, and were soon given up. Similar objectives were made by Powell and Lealand, but they discontinued their production after they had brought out their "new formula" which had separate fronts for dry and water immersion work.

This Ross lens is a 1/8 by measurement; its aperture is 0·81 dry, and 0·83 wet, so that it would be quite incapable of resolving *Amphipleura pellucida*.

The figure attached is not to scale, but is given to show the form of the lenses.

Howland's Instrument for Centring, Marking, and Testing Lenses.*—C. W. Howland has patented this instrument, which is intended to centre, or decentre lenses, as desired. It also axis-marks cylindrical lenses, so that they can be cut to any axis without adjusting the lens-cutter. The instrument also shows the strength of prismatic lenses, and it tests finished prescriptions, indicating whether they have been filled correctly.

The frame of the instrument comprises a stand with a bed, on which are three brackets (fig. 30). At one end is a fixed bracket with a sight tube, and a blinker for the eye not in use. The standard at the other end carries a protractor, in which is a target revolvable by turning a rod at the right-hand side of the bed, looking towards the target. The same serves as a push-and-pull rod to adjust the position of the target along the bed, according to the focus of the lens. At the left side is a link, pivoted to

* Optical Instrument Monthly (New York) i. No. 3 (Aug. 1905) pp. 24–6 (1 pl. and 8 figs.).

the middle bracket, or lens rest, and containing one or more not
intended to engage a pin and hold the target-carriage at a fixed dist
when testing prismatic power. The lens rest comprises a ring carr
a glass plate, against which the lens to be tested, marked, etc., is hel
hand or otherwise on the optical axis extending from the sight tu
the target centre. Pivoted to the bottom of the middle bracket i
arm holding a little shaft placed at right angles to the vertical p
through the axis of the instrument. This shaft carries three mar

FIG. 30.

pins, which, when the arm is lowered, strike an ink-pad, and, when
arm is raised, stamp the lens at three points in the same straight l
coincident with the horizontal major axis of the lens. During
swing of the arm the shaft carrying the ink-pins executes a quarter-tu
under the influence of a cord which passes over a drum on the sh
and is kept taut by a spring. The rotation of the shaft is limit
by stop-fingers. The marking pins are yielding, so as to compensate
the amount of projection of different parts of the surface of the lens.

Detailed descriptions of the use of the instrument are given.

(3) Illuminating and other Apparatus.

High-Angle Condenser Carrier for Petrological Microscopes.*—In connection with their Petrological Microscope, Watson and Sons have recently introduced a new arrangement for quickly removing the upper portion of the condenser from the field of view without the removal of the polariser or other apparatus.

The upper portion of the condenser mount, containing the lens which produces the high-angled convergence, is carried on a holder which is fitted into the stage itself. This holder can be immediately turned on a pivot so as to bring the condenser into the optical axis, or remove it therefrom. When high-angled convergent light is required, the holder is turned so as to bring the condenser to the centre of the stage—it is then just below the surface. The polariser is then pushed upwards, and in so doing lifts the condenser from its holder and carries it upwards to the surface of the stage. When the condenser is not required, the polariser is lowered until the condenser rests once more on its holder, when it can be at once turned aside.

Miller Sub-Stage Spark-Gap Lamp for the Microscope.†—T. I. Miller has arranged this apparatus (fig. 31) for photographing thin sec-

Fig. 31.

tions of minerals while fluorescing. It is not possible to give exact dimensions of the apparatus, because these must vary with the requirements of the Microscope selected. A piece of vulcanite $\frac{3}{8}$ in. thick and about 1 in. wide, is made with a base for two metallic terminal balls each $\frac{3}{16}$ in. in diameter, and mounted on pins having a tapered point. These pins are driven into holes drilled in the vulcanite. Two wires of thin copper are then wound around the pins, and connected to the secondary of a $\frac{1}{2}$-in. induction coil. This "lamp" is fastened to the sub-stage of the Microscope by machine screws, which loosely fit through the slots. By this construction it is quite easy to adjust the spark to the centre of field, or entirely out of field. The balls may be made of various metals, and provided with tapering holes to fit the pins, thus making it easy to use various metals whose spectra and effect on the mineral section are

* W. Watson and Sons' Catalogue, 1906, p. 79.
† Optical Instrument Monthly (New York) i. No. 3 (Aug. 1905) pp. 13–14 (3 figs).

known to be quite different. The balls must be mounted just high enough to be a little below the level of the top of the Microscope stage. The secondary of the induction coil is stepped up with a half-pint Leyden jar. An ordinary telegraph key was found most convenient for making and breaking the current. The mineral sections are ground as thin as possible, washed free of balsam, and then cemented around the edges to ordinary slides. The slides are reversed when placed on the Microscope stage, and the section should lie just clear of the balls.

Some Notes on Laurent Polariscope Readings.*—G. W. Rolfe and C. Field have made two series of rotation measurements of two standard quartz plates on a Laurent polariscope, one set with the light designed to be used by the Laurent polariscope, sodium-chloride light filtered through a section of bichromate crystal; the other set with sodium-chloride light passed through a Lippich ray filter. The instrument used was a Laurent "large model," made about 1888 by Léon Laurent, of Paris.

The authors conclude that it is imperative, in stating that the light factor of a saccharimeter is a certain value, that reference should be made (1) to the exact nature of the light used in the rotation readings; (2) the saccharimetric standard of the scale of the quartz-wedge instrument; (3) the nature of the substance measured; and (4) obviously, the temperature at which the comparisons are made.

Quartz-Plate Readings in Saccharimetry.†—G. W. Rolfe gives his reasons for considering that the Landolt-Lippich polariser is not as satisfactory for instruments for general laboratory use as the Laurent, because the former requires that all extraneous light be rigidly excluded, and seems much more sensitive to small variations in intensity of the sodium flame than does the Laurent. Only under constant conditions of temperature and light intensity, and with a rigid exclusion of all extraneous light, can good results be obtained with the Lippich polariscope.

A New Spectrometer: its Uses and Advantages.‡—V. H. Mackinney has designed a new form of spectrometer, whose main features may be tabulated as follows:—

(*a*) Both tubes are auto-collimating telescopes, and both are made to rotate in the horizontal plane.

(*b*) The illuminant is central above the prism table, and hence, once set, is constant on the slits whatever position they may occupy round the circle. There is a shade below to prevent stray light from interfering with the observations.

The advantages gained by these new features may, to start with, be briefly tabulated as follows:—

(*a*) The refractive index of a prism can be determined whatever its angles may be, for the new instrument adapts itself for determining it by any of the following methods:—(1) position of normal incidence; (2) minimum deviation; (3) critical incidence; (4) return path (Abbe) method.

* Technology Quart. Proc. Soc. Arts, Massachusetts, xviii. (Sept. 1905) pp. 219–93. † Tom. cit., pp. 294–9.

‡ Paper read before Optical Society, London (Feb. 1906) 8 pp., 13 figs.

(*b*) By having two auto-collimating telescopes, not only is a check obtained by taking an observation through one eye-piece and then through the other, but a further check is readily obtained by passing the light through the prism in a similar but opposite manner.

(*c*) The error due to auto-collimation is eliminated when method (1) (normal incidence) is employed, by taking the mean of two observations—with illuminating prism and cross-wires to right and left, or *vice versa*, of field respectively. The same applies to the "critical incidence" method, which, however, is not apt to produce such accurate results, owing to the difficulty met with in placing the cross-wires to exactly cut the half-light and half-dark field.

Optical Bench for Illumination with either Ordinary or Monochromatic Light.—The firm of R. and J. Beck has designed a small optical bench for microscopical illumination, which is suited for use with the Rosenhain Microscope, as well as for other purposes, and has a series of very handy adjustments (fig. 32).

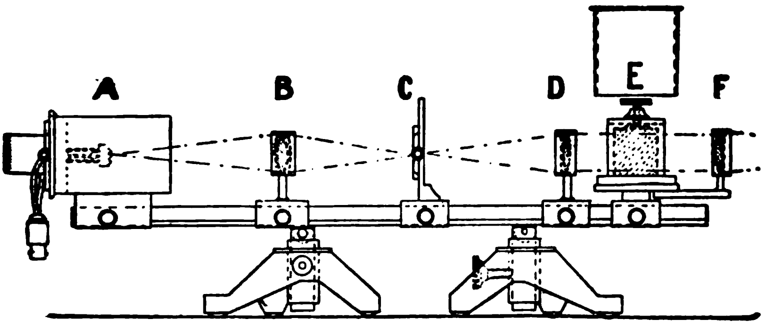


FIG. 32.

It consists of a 30-in. steel bar mounted on two strong tripod feet by means of two sliding uprights which can be raised or lowered and clamped at different heights, in fittings carried in the tripod feet, so that the bar can be placed at different heights above the table, or can be pointed either upwards or downwards.

All the pieces of the apparatus slide along the steel bar, and are accurately aligned to the same centre or axis. Each piece can be clamped in any position.

At one end A is a Nernst lamp with a single upright filament giving from 100–230 candle-power. It can be used with a slight modification in the burner on any current from 110–220 volts, but to give the highest candle-power should be used with the highest current. Next to the lamp is an achromatic and aplanatic condenser B, $1\frac{3}{4}$ in. diameter, which is corrected to give a well-defined image of the filament on the slit C; this is adjustable by means of a screw.

An achromatic collimating lens D collects the light from the slit C and emits it in a parallel bundle to a Thorp's diffraction grating on a prism, with rotating adjustment and brass cover, which transmits a

normal spectrum, which is again focused by means of an achromatic condensing lens F upon either the vertical illuminating apparatus of the Rosenhain Microscope, upon the surface of an object, or upon the mirror of an ordinary Microscope. It is generally advisable to interpose a screen with a broad slit in the focus of this lens if but one coloured light is required, especially if the bench is being used to illuminate a substage condenser for transmitted light. Such a screen is most conveniently carried on the Microscope itself, but in the case of the vertical illuminator of the Rosenhain Microscope it is made to slide into the fittings of the body.

The above describes the bench as used for monochromatic illumination, but for ordinary illumination the diffraction grating and prism E, with the condenser F and the slit C, are removed. An iris diaphragm and a water cooling chamber G may be used, and if desired a 4-in. lantern condenser may be used instead of the condenser B. A mirror on carrier H may be supplied to fit the bench. A lantern carrier and projection lens convert the whole apparatus into a most convenient and serviceable optical lantern.

An incandescent gas lamp may be supplied in place of the Nernst lamp.

(4) Photomicrography.

Method for Determining the Exact Colour for Light Filters.— E. Moffat communicates the following easy method for determining the exact colour of screen required to photograph successfully a faintly stained slide of Bacteria, etc. Place some crystals of chlorate of potash or salicin (the crystals of which give a good range of colour) under a Microscope, and examine by polarised light. Revolve one of the prisms till any one of the crystals matches exactly the stained preparation: now turn the prism round 90°, when the complementary colour will appear. This will show the exact tint required for the screen, and will produce the greatest amount of "darkness" or contrast, e.g., bacilli stained faintly blue will require a very dark orange screen, or if stained faintly red, a dark green will be required; the lighter the stain, the darker must be the screen, and vice versa, in order to produce a sharp image on the photographic plate. Hence the saving of time in using the polariscope to determine the required depth of tint. Isochromatic plates must be used in conjunction with these screens. To prepare the screens fix unexposed dry plates in the dark room and stain with any suitable dye.

(5) Microscopical Optics and Manipulation.

Artificial Double Refraction, due to Ælotropic Distribution, with Application to Colloidal Solutions and Magnetic Fields.*—T. H. Havelock, after reviewing the methods of artificially obtaining double refraction, and after investigating the theory of their formation, summarises the sections of his paper thus:—

1. The formal investigation of artificial double refraction in colloidal solutions as due to a deformation of the medium, consisting of a change in the packing of the colloidal particles.

* Proc. Roy. Soc., Series A, lxxvii. No. A 515 (Feb. 1906) pp. 170–82.

2. The possibility that such deformation may be produced by mechanical stress as arising from the possession of a certain amount of rigidity by such solutions.

3. The analogy between the effects so produced, and the double refraction due to a magnetic field.

MAILLARD, L.—**La Loi de la Réfraction et le principe de la moindre action.**
[An interesting historical review of the theories of refraction.]
Bull. de la Soc. Vaudoise des Sci. Nat. (*Lausanne*), xli. (Sept. 1905) pp. 173–95 (7 figs.).

NUSSELL, A. H.—**On a Scale of Colour-Values and a new Photometer.**
Technology Quarterly, xviii. (1905) pp. 60–72 (10 figs.).

ROHR, VON M.—**Die Optischen Instrumente.**
Leipzig: B. G. Teubner (1906) v. and 130 pp.

SCHNEIDER, J., & J. JUST—**Ultramikroskopie der Oleosole.**
[On the application of ultramicroscopy for testing the purity of oils and oleaginous mixtures.] *Zeitschr. Wiss. Mikrosk.*, xxii. (1905) pp. 481–530.

THORP, T.—**Replicas of Diffraction Gratings.**
Nature, lxxiii. (1905) p. 79.

WALLACE, R. J.—Ditto. *Astrophysical Journal*, xxii. No. 2.
See also *Nature*, lxxiii. (1905) p. 21.

ZSIGMONDY, R.—**Zur Erkenntniss der Kolloide. Ueber irreversible Hydrosole und Ultramikroskopie.** (An account of the nature and properties of colloid solutions or hydrosols, and of the investigation by the method of ultramicroscopy.)
Jena: Gustav Fischer (1905) vi. and 185 pp.

(6) Miscellaneous.

Advances in Microscopy: The Microscope at Work.*—J. W. Gordon dealt first with the subject of metallography, which he traced to Dr. Sorby's work in Sheffield in 1864, illustrating its use in engineering by a number of lantern slides lent for the purpose by Mr. J. E. Stead, F.R.S., exhibiting the microscopic structure of steel.

From this topic an easy transition served to introduce the subject of the changes which the surface of a polished piece of metal undergoes in the process of polishing. This part of the lecture was illustrated by photographs lent by Mr. G. Beilby, of Glasgow, who has made a special study of the physical condition of metals as affected by heat, and particularly by the treatment which they undergo in the polishing process. His inquiries show that enormous forces, comparatively speaking, are brought to bear upon the exquisitely thin film of metal which is directly affected by the polishing operation in the act, for instance, of knife cleaning; and as the result of the hard usage to which this surface film is subjected it carries permanent traces of having been spread like a fluid over the solid foundation of underlying metal. A very remarkable series of photographs illustrated this point, and showed how a polishing tool left the surface of a piece of brittle metal like antimony in streaks like the brush marks of paint.

The next topic dealt with was the application of the Microscope to the healing art—and here the lecturer selected for special notice the

* Lectures at the Royal Institution, Feb. 1906.

work recently accomplished by Professor A. E. Wright. This relates to the employment of the Microscope as a part of the physician's equipment in the ordinary work of treating such diseases as arise from microbic invasion. It is well known that nature's remedy for such diseases is found in the activity of a certain type of white blood corpuscle, itself a microbe of a very militant order, which voraciously devours the smaller microbes of the morbid kinds. It is found, however, that this phagocyte is not always on the alert, and Professor Wright's investigations have led him to the conclusion that the secret of the phagocyte's activity is to be sought in the composition of the blood serum. He has, accordingly, devised a system of measurement for the stimulating property of the blood fluids. A minute sample of the patient's blood furnishes the required specimen of serum, and to this serum is added a pure culture of the noxious bacterium. This mixture being placed in an incubator, a certain number of phagocytes are let loose, and allowed to play in it for a regulated period of time. A sample of the mixture is then withdrawn and examined under a Microscope, and some 50 or 60 specimen phagocytes are taken, from which an average is deduced of the amount of execution which the phagocyte can do in that medium. If the result of that examination is satisfactory, then the patient's blood is in such a condition that inoculation treatment can be successfully applied. If, however, the phagocytes prove not to be very keen in seizing and appropriating their destined prey, then the system of treatment has to be directed to improving the condition of the patient's blood before commencing the inoculation treatment. A photograph of a phagocyte with ingested tubercle bacilli, enabled the audience to appreciate the precision of this method.

The Microscope adapted to Special Duty.*—In his second lectur Mr. Gordon referred first to a topic which, under pressure of time, wa omitted from the previous lecture, that is to say, the limit of visibilit This subject has been much under discussion in recent times, and Lo Rayleigh has of late investigated it with very remarkable results. now appears that objects such as a bacterium or that minute appenda called a flagellum, which many bacteria carry, may be seen althoug attenuated much beyond the point hitherto commonly supposed to the inferior limit of microscopic vision. The importance of this fa lies in the circumstance that many bacteria are so minute that it difficult to make out their distinctive features, and the study of the delicate but vitally important forms of life, taxes our present Microscop to the limit of their capacity.

The lecturer next demonstrated by means of a Microscope, lent the purpose by Mr. C. Baker, the appliances which are employed in t metallographer's Microscope to illuminate the surface of an opaque obj such as a polished slab of metal, describing particularly the constructi of the vertical illuminator and the method of focusing adopted un these conditions. He then passed to consider modifications directed improving the resolving power of the instrument, and showed by a v striking experiment how a thin film of some transparent body, such

* Lectures at the Royal Institution, Feb. 1906.

a drop of water hanging upon the surface of a glass plate, can be rendered conspicuously visible by cutting down the image-forming beam in a particular position. The experimental result goes somewhat beyond the theoretical explanation at present available. The experiment itself had been designed with the idea of introducing a diffraction fringe into the field of the instrument and utilising the high resolving power which such a fringe is, on grounds of theory, supposed to possess. But the increased visibility of the image shown up in this way is so very pronounced that there is reason for thinking that the diffraction fringe does not completely explain it. The result is to exhibit a transparent object under the aspect known to microscopists as dark field illumination, but without any of the appliances commonly employed for bringing about that result.*

Another appliance directed to the same general object of improving the resolving power of the Microscope is the apparatus devised by Dr. A. Köhler for utilising ultra-violet light having a wave-length of about $\frac{1}{100000}$ in. A description of this apparatus has already appeared in this Journal, 1905, pp. 103 and 513. The exclusion of glass from the optical system makes it impossible to obtain the ordinary corrections for chromatic aberration, and the objectives prepared for use with this instrument are accordingly designed as monochromatic, that is to say, they are correct for one particular wave-length only. This elaborate instrument is at present in the probationary stage, and it does not seem possible to speak as yet with confidence of its capacity for high-power work. But its use at moderate magnifying powers has shown that light of the particular wave-length mentioned is arrested by certain tissues which are quite transparent to ordinary visible light, and in that way structure can be demonstrated in unstained specimens by the aid of colour reactions by latent stains, as we may say, to reveal which ordinary light would be wholly inoperative. Special attention was drawn by the lecturer to this very notable property of monochromatic light and to the simplification of the correction problem accomplished by the production of monochromatic objectives. In both these particulars he thought that the principles exemplified by Dr. Köhler's design might usefully be extended to instruments designed for working with monochromatic light within the range of the visible spectrum.

The last subject dealt with was a photomicrographic apparatus recently introduced by Messrs. Beck. This is designed to meet the requirements of practising engineers and doctors, and reduces the apparatus and procedure employed in the production of a photograph of a microscopic object to extreme simplicity.

A full description was given at a recent meeting of the Society, and may be found in the Journal, 1905, p. 651.

Quekett Microscopical Club.—At the Meeting held on Jan. 19, the President, Dr. E. J. Spitta, F.R.A.S., F.R.M.S., in the chair, the Hon. Sec. announced that two papers had been communicated by Mr. T. B. Rosseter, F.R.M.S., on "*Drepanidotænia undulata*," and on "*Drepanidotænia sagitta*."

* This experiment forms the subject of a Note on p. 157 of this Journal.

Mr. R. T. Lewis, F.R.M.S., delivered a lecture on "The Senses of Insects," dealing more especially with sight and hearing.

The 40th Annual General Meeting was held on Feb. 16. The President delivered the Annual Address, taking as his subject "The Relative Merits of the Short and Long Tube for Microscopes." The short tube was probably introduced by Oberhäuser, certainly before 1857. The advantages claimed for each form were dealt with, and the President, in conclusion, said he considered the short tube to be the ideal stand, as it could quickly be converted to the long form, and objectives corrected for either tube-length alternately employed if desired.

The 429th Ordinary Meeting was held on March 16. Mr. C. D. Soar, F.R.M.S., delivered a lecture on "The Life-History of Freshwater Mites (*Hydrachnidæ*)." The various stages—ovum, larva, nymph, and adult, were described and illustrated with the aid of the lantern. Of the sixty genera known, we have information regarding the life-history of only five.

B. Technique.*

(1) Collecting Objects, including Culture Processes.

Differentiation of the Bacillus putrificus.†—A. Rodella discusses the results obtained by Achalme and others in the differentiation of *B. putrificus* and allied anaerobic organisms by their ferment action on certain hydrocarbons. He finds that the fermentation of hydrocarbons does not alone serve to differentiate either the nine bacilli studied by Achalme, nor the other anaerobic micro-organisms that have the property of fermenting albuminoid substances; that in the classification of these anaerobes the fermentation of hydrocarbons is to be considered, but especially the fermentation of proteid substances. The author found that in nearly all milk cultures lactose remained unaltered even after four weeks, and he considered that the fatty acids that were formed were derived from the fermentation of the casein. Some bacilli form with casein only butyric acid, others valerianic acid, and others caprionic acid.

Culture of Bacillus lepræ.‡—P. Emile Weil finds that for the cultivation of the *Bacillus lepræ*, it is necessary to select exclusively cases of tuberculous leprosy, and especially those that show recent tubercles. The surface of a tubercle being first washed with ether, is abraded with a sterile scarifier, and into the leprous mass is introduced a fine sterile pipette, which removes a short cylinder of yellow matter containing the bacilli. From this the culture tubes are inoculated; the media employed being glycerin glucose agar in various proportions, but always rendered neutral or alkaline, to which was added human pleuritic serum. Egg agar was also found especially useful. The tubes were incubated at 39° C. Growth appeared in about 15–20 days.

* This subdivision contains (1) Collecting Objects, including Culture Processes; (2) Preparing Objects; (3) Cutting, including Imbedding and Microtomes; (4) Staining and Injecting; (5) Mounting, including slides, preservative fluids, &c.; (6) Miscellaneous.

† Ann. Inst. Pasteur, xix. (1905) p. 804. ‡ Tom. cit., p. 793.

Magnesium Phosphate in the Preparation of Media.*—A. Cache recommends the following method for the preparation of bouillon. Take 250 grm. of meat, 500 grm. of water, and 1 grm. of $MgNH_4PO_4$, and allow the mixture to stand in a flask for 24 hours in the cold. On filtering, 500 grm. of meat extract are obtained, the alkaline reaction of which is then estimated. Add 1 p.c. of pepton and 0·5 p.c. of NaCl, thoroughly shake the mixture, and place in autoclave for 2 minutes at 120° C. After filtering, when cool, there is obtained a clear fluid slightly alkaline to litmus. In this medium the author finds that micro-organisms develop better and retain their virulence longer than in media prepared after the usual method.

Early Diagnosis of Typhoid Fever.†—H. Conradi has devised a method by which a diagnosis of the presence of *Bacillus typhosus* in the blood can be demonstrated in not more than 32 hours. It is based on the observation that the blood *in vivo* is less bactericidal than *in vitro*, under which latter condition substances are developed which exert a disinfectant action as a result of coagulation. Coagulation is prevented by the use of bile, the important components of which in respect of this action are due to glycocholate and taurocholate of sodium. The medium consists of bile, 10 p.c. pepton, and 10 p.c. glycerin. The blood is obtained by pricking the ear, and allowing it to pass into a capillary pipette containing a small quantity of bile fluid. From the capillary pipette the mixture is transferred to a small glass tube containing 2–3 c.cm. of the pepton-glycerin-bile medium. The process of transference is continued until the ear ceases to bleed. The proportion of blood used must be as 1 to 3 of the medium. The tube is incubated at 37° C. for 10–16 hours, and cultures are then made on the Drigalski-Conradi agar plates.‡

New Method of Differentiating Bacillus typhosus and Bacillus coli.§—L. S. Dudgeon read a preliminary communication before the Pathological Society on the use of urotropin medium as a means of diagnosis between *B. typhosus* and *B. coli*. From a series of experiments he found that the most suitable strengths of urotropin were 0·1 p.c., 0·5 p.c., and 1·0 p.c., more especially in a broth medium. He had also employed the same strengths of urotropin in agar, both for slants and for plating. He had experimented with cultures of *B. typhosus* obtained from two cases of bone abscesses, and stock cultures isolated from the spleen in cases of typhoid fever. The results were constant. *B. typhosus* grew well in 0·1 p.c. urotropin broth, fairly well in 0·5 p.c., but the growth was delayed; 1 p.c. urotropin broth was always sterile, whereas *B. coli* obtained from cases of peritonitis and cystitis gave an abundant growth in 0·1 p.c. and 0·5 p.c., and a fair growth in 1 p.c. If a tube of 1 p.c. urotropin broth were inoculated with the typhoid bacillus and incubated at 37° C. for 24 hours, and then considerably diluted (twice and three times), and then reincubated, no growth resulted in any case. A paratyphoid bacillus (Kràl) was found to grow well on

* Centralbl. Bakt., Orig., 1te Abt., xl. (1905) p. 255.
† Deutsche. Med. Wochenschr., Jan. 1906. See also Brit. Med. Journ., 1906, i. pp. 339–40. ‡ See this Journal, 1902, p. 371; 1904, p. 369; 1905, p. 259.
§ Brit. Med. Journ., 1906, i. pp. 143–4.

0·1 p.c. urotropin agar, a very slight and delayed growth occurred in 0·5 p.c., while only one colony was obtained on 1 p.c. at the end of 11 days' incubation at 37° C. A paratyphoid bacillus (L.) gave a good growth in 0·1 p.c. urotropin broth, a fair growth in 0·5 p.c., and a faint growth in 1 p.c., which was considerably delayed. A paratyphoid bacillus (S.) gave a similar result in 0·1 p.c. and 0·5 p.c., but failed to grow in 1 p.c. urotropin broth. *B. pyocyaneus* gave an abundant growth in all three strengths of the urotropin medium. The author stated that these experiments were being continued and various modifications were being tried.

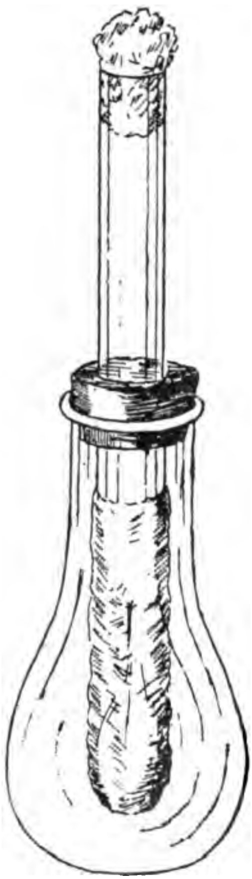


Fig. 33.

New Method of Isolating Bacillus typhosus from Infected Water.*—H. S. Willson's method is as follows. A stock solution of alum in distilled water, 10 grm. to 100 c.cm., is used; 0·5 grm. alum is added to each litre of infected water. The whole is well stirred, and a known quantity withdrawn and centrifuged for 15 minutes at 2000 revolutions, the supernatant fluid save 1 c.cm. poured off, the residue stirred and plated on the Drigalski-Conradi medium and incubated at 42° C. for 24 hours, the resulting colonies being tested by the agglutination method and subcultures. Numerous experiments were performed with water infected to a known amount, and some on a large scale in galvanized iron tanks. In these tanks the bacilli died out in 6 days, owing to the action of the zinc-iron coating.

In conclusion, the author advocates the conversion of the suspected water into a nutrient medium (water + 1 p.c. nutrose + 0·5 p.c. caffeine + 0·001 p.c. crystal violet) by the caffeine method, which enriches the *B. typhosus* at the expense of the other organisms; but on account of the variability in action it should be supplemented by the precipitation process.

Method for keeping Cultures Alive indefinitely.†—P. Murillo records the following method for keeping cultivations of bacteria alive for protracted periods. A collodion sac made in the usual way is fitted over the lower end of a piece of glass tubing. The tube is adjusted in the neck of an Erlenmeyer's flask by means of a perforated rubber stopper. The tube and the flask are then filled with a suitable quantity of broth, and after the tube has been plugged with cotton wool the whole apparatus (fig. 33) is sterilised. Inoculations are then made in the usual way. The appa-

* Journ. Hygiene, v. (1905) No. 4.
† Bol. Inst. Alfonso XIII., i. (1905) pp. 180–91 (5 figs.).

atus was originally devised for keeping diphtheria bacilli alive, but it was found that the broth in the flask soon became highly virulent owing to diffusion from the sac, and that bacteria remain alive much longer in this apparatus than had been anticipated.

Gage, Stephen De M.—**The Bacteriolysis of Peptones and Nitrates.**
[Deals with the biochemistry of sewage purification.]
Technology Quarterly, xviii. (1905) pp. 5–39.

(2) Preparing Objects.

Demonstrating the Structure of Corals.*—F. Menneking, in his research on certain Corals, used material which had been preserved in spirit and decalcified with sulphuric acid. The material was then hardened in graded alcohols and imbedded in paraffin. The sections were stained with hæmalum.

Besides the ordinary paraffin imbedding, the author also adopted Schoenemann's method † for bone, with good results.

Trichloracetic Acid as a Fixative.‡—M. Heidenhain recommends the use of trichloracetic acid for fixing tissue. From an experience of ten years he has found its action very satisfactory in from 5–10 p.c. solution. Its one defect is that it makes connective tissue swell up, but this inconvenience is obviated by after-treatment with absolute alcohol, which should be frequently changed and allowed to act for a considerable period.

Presence of Negri's Bodies in Rabies.§—A. Bongiovanni obtained negative results when experimenting on rabbits with fixed virus; in the controls with street virus Negri's bodies were always present. The parts examined were cornu ammonis, cerebellum, Gasserian and spinal ganglia. The pieces were fixed in Zenker's fluid, and the sections stained by the methods of Fasoli,‖ of Mann, with Ehrlich's acid-hæmatoxylin, and with Heidenhain's iron-hæmatoxylin.

Part of the research was to ascertain the effect of radium. The results show that the action of the rays delayed the activity of the virus and postponed the inevitable termination.

Demonstrating the Phenomena of Maturation in Oogenesis and Spermatogenesis.¶—P. Lerat used *Cyclops strenuus* only in his researches, obtaining the specimens chiefly from pools and puddles. The water was filtered, and after the removal of such animals and plants as could be descried, the *Cyclops* were found in the stem of the funnel. These were killed by immersion in Gilson's fluid for about 10 minutes and afterwards washed in water for about half-an-hour. *Cyclops strenuus* was then picked out under a Microscope. Fixation and imbedding were performed in test tubes, a procedure which lent itself to an easy change

* Archiv Natur., lxxi. (1905) p. 246.
† See this Journal, 1903, pp, 107 and 371.
‡ Zeitschr. wiss. Mikrosk., xxii. (1905) pp. 321–4.
§ Atti R. Accad. Lincei., xiv. (1905) pp. 454–62.
‖ See this Journal, 1905, p. 386.
¶ La Cellule, xxii. (1905) pp. 163–98 (4 pls.).

of fluids and also prevented loss of the animals. When this manipulation was finished the test tube was broken and the paraffin block extracted. It was found to be important to keep the animals in one-third alcohol for 10 minutes, and for 6 hours in 50 p.c. alcohol, and to carry the imbedding through slowly. Some difficulty was experienced in making sections, as the carapace was easily fractured though the internal parts were easily manipulated. The best stain was Heidenhain's iron-hæmatoxylin.

Demonstrating the Presence of Indigo.*—H. M. Leake, for his investigation on indigo-yielding plants, placed pieces of the material in the following mixture: acetic acid 2 c.cm., sulphuric acid 1 c.cm., ammonium persulphate 0·5 grm., water 100 c.cm. According to size the pieces remained in the fixative for from 4–12 hours. They were next placed for 3–4 days in 50 p.c. alcohol, changed daily. The sections varied from 4–12 μ in thickness. They were stained in Delafield's hæmatoxylin and decolorised with hydrochloric acid alcohol. They were next placed for an hour or so in 1 p.c. Grübler's water-soluble eosin; then absolute alcohol, xylol, and balsam. The indigo contents of the cells were clearly shown.

Demonstrating the Structure of Nucleoli and Chromosomes.†—T. Martins Mano used *Phaseolus vulgaris* and *Solanum tuberosum*, the grains and tubercles of which were germinated at different temperatures. The material was fixed in Hermann's, Bouin's, or Perenyi's fluid, the first mentioned giving the best results. Sections from 5–7½ μ thick were stained with Heidenhain's hæmatoxylin, either alone or with Congo or Bordeaux red, with light green and safranin, with Delafield's hæmatoxylin and picric acid, and other dyes.

Heidenhain's hæmatoxylin gave the details of nuclear structure more clearly than other solutions.

Studying the Nervous System of Asterias rubens.‡—R. Meyer obtained the best staining results from the use of molybdic acid hæmatoxylin and Malory's hæmatoxylin after fixation in sublimate acetic acid (saturated solution of sublimate in hot sea-water, 100 parts, and 2 parts of acetic acid). An excellent fixation and staining reagent was found in a mixture of 1 part of 1 p.c. osmic acid and 3 parts of the above-mentioned sublimate acetic acid. After 12–15 hours the objects were washed in sea-water for 6 hours and then for a similar period in pyroligneous acid, followed by another course of sea-water. The sublimate was removed in iodine alcohol, and after dehydration in alcohol the material was passed through chloroform to paraffin.

Observations on the Structure of Pleistophora periplanetæ.§—W. S. Perrin examined the living plasmodia inhabiting the malpighian tubules in normal salt solution. Films were prepared by cutting the tubules into small pieces and spreading them on a coverslip. After

* Ann. Bot, xix. (1905) p. 297.
† La Cellule, xxii. (1905) pp. 57–76 (3 pls.).
‡ Zeitschr. Wiss. Zool., lxxxi. (1906) pp. 96–144 (2 pls.).
§ Quart. Journ. Micr. Sci., xlix. (1906) pp. 615–33 (2 pls.).

drying and fixation in alcohol they were stained with Giemsa's modification of the Romanowsky-Nocht stain. The best results were obtained by leaving the films overnight in a mixture of an aqueous solution of eosin and azur ii. (10 parts of a solution of 1 grm. eosin B.A. in 1000 c.cm. water and 1 part of a solution of 0·8 grm. azur ii. (Grübler) in 1000 c.cm. water.)

After staining, the coverslips were washed in tap water, then dipped in alcohol, washed again in water, dried, and mounted in cedar-wood oil. A second method was to cut up the tubules in a very small drop of filtered egg-white and fix with osmic acid vapour, or with a mixture of boiling sublimate and alcohol in the proportion of 2 to 1. After osmic the film was washed in water, after sublimate in the water plus iodine, the film being in each case previously passed through graded alcohols, or stained straightaway in Delafield's hæmatoxylin. The excess of stain was then washed out in acid alcchol and the film mounted in balsam.

Preparing Unfertilised Eggs of Tenthredinidæ.*—L. Doncaster obtained eggs of different ages, noting the time when any row of eggs was laid. In this way series of eggs of all ages up to about 4 hours were preserved. In most cases a row of eggs was imbedded entire, and the eggs cut one after another still attached to the leaf. The best fixative was found to be Petrunkewitsch's modification of Gilson's solution (water 300 c.cm., absolute alcohol 200 c.cm., glacial acetic acid 90 c.cm., nitric acid 10 c.cm., sublimate to saturation). The difficulty of saturating the eggs with paraffin was obviated by transferring the eggs from absolute alcohol to cedar oil, where they were allowed to remain for a considerable time, and then passing through xylol, xylol-paraffin, to paraffin.

The only stain that gave satisfactory results was Heidenhain's iron-hæmatoxylin.

Studying Bucephalus Haimeanus.†—D. H. Tennant found that the best fixative for *Bucephalus* was Flemming's chrom-osmic-acetic mixture (weaker formula). Tissues were allowed to remain in this reagent for 24 hours, and were then washed in running water for a similar period. For *Gasterostomum* a cold saturated aqueous solution of sublimate, warmed to 35°, was the most satisfactory. The most successful stains were Flemming's triple stain (safranin, gentian-violet, and orange G), and Heidenhain's iron-hæmatoxylin and eosin.

Demonstrating the Development of the Oculomotor Nerve of the Chick.‡—F. W. Carpenter first opened the orbital cavities and placed the whole head in vom Rath's mixture. After 3–5 days the material was carried through several changes of 70 p.c. alcohol, and then the head preserved in a mixture of alcohol and glycerin. Certain portions of the orbit were also fixed in Zenker's fluid or in osmic acid. These were dehydrated in alcohol and paraffin-sections made, and when Zenker's fluid had been used, were stained in acid fuchsin. The ciliary gasserian, and sympathetic ganglia were treated with 0·05 p.c. chromic

* Quart. Journ. Micr. Sci., xlix. (1906) pp. 561–90 (2 pls.).
† Tom. cit., pp. 635–90 (4 pls.).
‡ Bull. Mus. Comp. Zool. Harvard, xlviii. (1906) pp. 141–230 (7 pls.).

acid for 2 or 3 days. They were then dissociated with needles, an stained with acid fuchsin.

The most satisfactory results were obtained from vom Rath's fixa tive, and the Heidenhain iron-hæmatoxylin stain. The formula fo vom Rath's fluid is 200 c.cm. saturated solution of picric acid, 1 grm platinum chloride dissolved in 10 c.cm. of water, 2 c.cm. glacial aceti acid, 25 c.cm. of 2 p.c. osmic acid. In this mixture embryo chicks wer kept for 3 days or more, the fluid being once changed. They were the washed for a minute in two changes of methyl-alcohol, and placed fo from 24–48 hours in a 0·5 p.c. solution of pyrogallic acid. They wer then passed through graded alcohols up to absolute, cleared in xylol, an imbedded in paraffin. No further treatment was required for th sections, though it was found advisable to leave the balsam uncovered.

The iron-hæmatoxylin was used after fixation in Zenker's fluid, o in saturated corrosive sublimate to which 1 p.c. glacial acetic acid ha been added.

Other stains used were brazilin and Delafield's hæmatoxylin Golgi's impregnation method and *intra vitam* staining with methylen blue were not successful. Van Gieson's was used for studying th formation of the sheath of Schwann. A combination of iron-hæmatoxyli and van Gieson brought out the cytoplasmic processes of the cell accompanying the nerve-fibres, as well as those of the mesodermal cells

Demonstrating the Connection between Epidermis and Cutis i Saurians and Crocodiles.*—F. Krauss fixed pieces of skin in Carnoy fluid, saturated solution of sublimate, picro-sublimate-acetic acid, Flem ming's fluid, and Zenker's fluid. Decalcification was effected with 5 p.c trichlor-acetic acid, or with nitric acid alcohol (1–4). The fixed materia was imbedded in celloidin or in celloidin-paraffin. To obtain thi sections (3–4 μ) it was necessary to brush the section-surface over wit mastic. This procedure could be used only with the paraffin sections for the celloidin-paraffin, thick gum arabic solution was used. Whe gum was used, the sections stuck on the slide had to remain in water long time to remove the gum completely.

The sections were stained with alum-carmin-hæmatoxylin, by va Gieson's, Unna's, and Weigert's methods. The following modifica tion of Weigert's method gave good results: alcohol-methyl-viole solution and anilin-water, 15–30 minutes; wash in salt solution, the iodo-potassic iodide solution for 30 seconds or 15 minutes, according t the effect desired (epithelial staining or collagen), 10 p.c. aqueous solu tion of tannin for 3–5 minutes; dry on blotting-paper, and decoloris in a mixture of xylol, 4 or 5 parts, and anilin oil, 1 part.

The foregoing procedure may be preceded by alum-carmin.

The elastic fibres were stained by Weigert's, or by the Unna-Tänze method.

Studying Sperm-Cells of Decapods.†—N. K. Koltzoff found tha the best preservative fluids were sublimate-acetic acid (5 p.c.), or subli mate alone. Fresh and salt water were used as solvents. Satisfactor

* Arch. Mikrosk. Anat., lxvii. pp. 319–63 (2 pls. and 14 figs. in text).
† Tom. cit., pp. 364–572 (5 pls. and 37 figs. in text).

results were also obtained with Zenker's and Bouin's fluids. Solutions containing osmic acid were found to be unsuitable. For staining the sections, Heidenhain's iron-hæmatoxylin or Benda's modification thereof, were mostly employed; previous treatment with Bordeaux red was sometimes satisfactory. The Biondi-Heidenhain triple stain gave beautiful results, but the colours faded in about a year.

Cover-glass preparations were made by mixing a small quantity of sperm taken from the testis, or from the receptaculum seminis, with a little sea-water, and fixing for several minutes in osmic acid vapour. These were stained by the Biondi-Heidenhain triple stain, or by Ranvier's gold and formic acid method.

The author strongly recommends that the living cells should be examined in serum, sea-water, or other isotonic fluid, as thereby important details are easily seen, the which are lost by fixation. The figures given on the plates were drawn with the Zeiss apparatus under magnifications of 1400 and 3500.

Fixing Pyrosoma.*—A. Korotneff treats the eggs and embryos of *Pyrosoma* for a good half-hour with half saturated solution of sublimate in sea-water. After careful washing, the material is immersed in Perenyi's fluid for an hour, and is then transferred to alcohol. Staining with alum-carmin was found to be useful, and immersion of the material in 5 p.c. formalin occasionally had the effect of completely dissolving the yolk and setting free the embryo.

Demonstrating Structure of Nephridia of Arenicola.†—R. S. Lillie fixed adult material for 15–30 minutes in Hermann's fluid, and then transferred to Whitman's modification of Merkel (equal parts of 1 p.c. chromic acid and 0·25 p.c. platinum chloride) for 1–3 hours. The material was next washed, and then transferred to alcohol as usual. The treatment with Hermann's fluid prevents excessive blackening, and the reduced osmium may be further removed by immersing the sections for some hours in a mixture of 1 part hydrogen peroxide and 3 parts alcohol. The most satisfactory stain was Heidenhain's iron-hæmatoxylin countered with erythrosin. The best mounting medium for examination with oil-immersion objectives was found to be inspissated cedar-oil.

Larvæ were best fixed by immersing them for 2–5 minutes in Hermann's fluid, followed by Merkel's fluid for 1–3 hours. Young larvæ of the swarming stage were treated with Hermann's fluid for two minutes, followed by Merkel's for 1 hour. Such larvæ should be imbedded as soon as they are fixed, otherwise the yolk becomes very brittle.

Demonstrating the Endings of the Auditory Nerve in Petromyzon fluviatilis.‡—R. Krause fixed the material in Flemming's, Hermann's, Zenker's and Carnoy's fluids. Exposure to the vapour of a mixture of equal parts of 4 p.c. osmic and acetic acids was specially favourable, the preparation being transferred after 10 minutes to 40 p.c. alcohol.

* Mitth. Zool. Stat. Neapel, xvii. (1905) pp. 295–311 (3 pls.).
† Tom. cit., pp. 341–405 (4 pls.).
‡ SB. k. Preuss. Akad. Wiss., xlviii. (1905) pp. 1017–19.

Sections were stained with the Ehrlich-Biondi triple stain, with Heidenhain's iron-hæmatoxylin, and those that had been treated with osmic acid fixative were previously bleached with peroxide of hydrogen (5–10 p.c. in 70 p.c. alcohol).

Staining the tissue en masse was simple and satisfactory. The pieces fixed in Zenker's fluid were washed in running water for 24 hours and then immersed for a like time in 0·2–0·5 p.c. hæmatoxylin solution which contained about 50 p.c. alcohol. After frequent washing the pieces were transferred to graded alcohols. For the finer details this procedure was especially effective. Pieces fixed in Carnoy's fluid may be treated in a similar way. They are transferred from the alcohol-chloroform-acetic acid mixture to absolute alcohol and then through down-graded alcohols to distilled water. The pieces are then stained in the previously described iron-hæmatoxylin solution for 24 hours, after which they are transferred to a solution consisting of 0·25 grm. potassium monochromate and 0·25 grm. potassium bichromate, dissolved in 100 c.cm. distilled water.

(3) Cutting, including Imbedding and Microtomes.

Reichert's New Microtome, with Double Bearings.*—The advantage claimed for this instrument is that the bearings of the knife-carrier

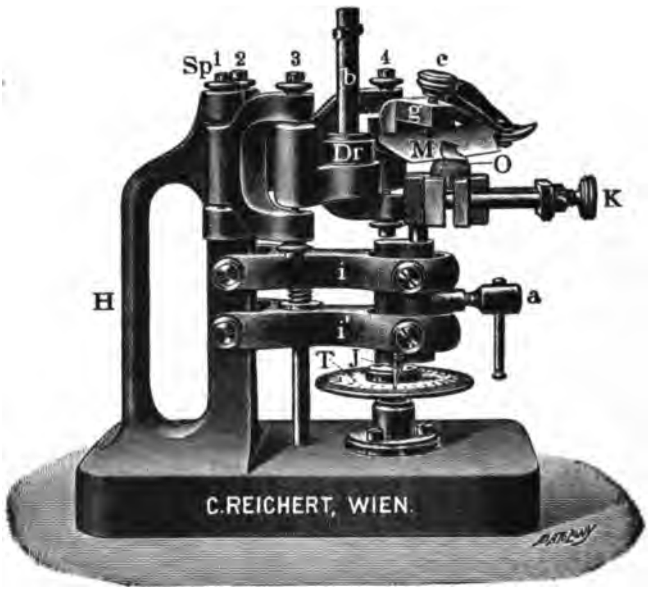


FIG. 34.

are double and are of a trapezium shape, owing to the different lengths of the four arms forming the bearings. In consequence the knife or

* Reichert's Catalogue, French edition, 1905–6, p. 15.

razor has an almost straight movement, a great advantage for sectioning delicate objects. The direction of the knife movement is indicated by

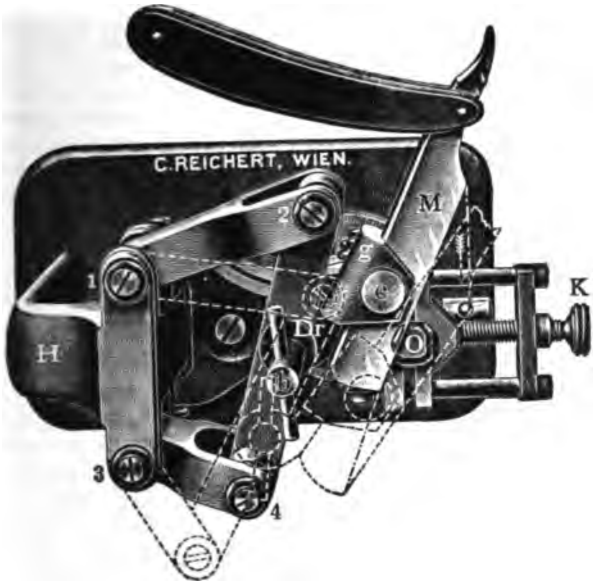


FIG. 35.

the dotted lines (fig. 35). The instrument (fig. 34), like that shown in the December Journal, 1905, p. 766, has a handle and a heavy base.

Preparing Liver for Demonstrating Hepatic Ferments.*—E. W. Carlier killed the animals (white rats) with coal-gas, and then washed out the blood vascular system very thoroughly with normal saline solution. The injection vessel was then filled with picro-corrosive formalin warmed to body temperature, and about half a litre passed through the animal. When the animal was cold the liver was dissected out, cut up into small pieces, placed in graded alcohols, beginning at 50 p.c. to chloroform and paraffin.

The most useful staining methods were Mann's methyl-blue-eosin, toluidin-blue-eosin, MacAllum's method for unmasking albuminoid iron, and Heidenhain's iron-alum-hæmatoxylin. The sections were cleared in inspissated turpentine and mounted in turpentine balsam.

(4) Staining and Injecting.

Demonstration of the Flagella of Motile Bacteria.†—E. W. Duckwall, after describing the necessary refinements he employs in the making of suitable cultures, according to the variety of motile organism under

* La Cellule, xxii. (1905) pp. 431–56 (17 figs.).
† Centralbl. Bakt., 1te Abt., Ref., xxxvii. (1905) p. 360.

examination, advises the following method. Round cover-slips thoroughl cleaned are preserved ready for use in absolute alcohol. A mordant i composed of 2 grm. of dry tannic acid, 5 grm. cold saturated solutio of sulphate of iron, 15 c.cm. of distilled water, 1 c.cm. saturated alcoholi solution of fuchsin, and to these he adds ½–1 c.cm. of a 1 p.c. solutio of sodium hydroxyl; the mixture after filtration being of a red-brow colour, and to be used within 5 hours after its preparation. A stain o carbol-fuchsin, prepared by adding to 1 grm. of granular fuchsin in flask 25 c.cm. of warm alcohol, shake, allow to stand for several hours and then dilute 4 or 5 times with a 5 p.c. solution of carbolic acid.

A small loopful of previously boiled distilled water made cloudy witl the culture of the organism is placed on a cover-slip, which is held culture side upwards in forceps and passed through a Bunsen flame; sufficien mordant is then poured on it to cover the surface; after ½–1 minut the mordant is washed away with tap water; a small quantity of alcoho is dropped on to the surface and again washed away; then pour on th stain and allow it to remain about ½ a minute, then warm until i steams; when the slip is completely dry, treat with xylol and mount ir xylol-balsam.

Demonstration of the Indol and Cholera-red Reactions.*—W. B Wherry finds that nitrites and also probably nitrates gain entrance t artificial media from various sources—certain waters, "peptones," an filter papers; and that a sufficient quantity of nitrites may be absorbe from the air of the laboratory to yield a distinct indol reaction on th addition of 0·5 c.cm. of chemically pure sulphuric acid. He therefor recommends that media used in testing for indol or cholera-red re actions should be examined for nitrates and nitrites before use. Th author finds that the cholera spirillum does not produce nitrites ir nitrate- and nitrite-free "peptone" solutions. The cholera-red reactior is not specific; it must be distinguished from the purple-coloured indo reaction.

Method of Producing Chromatin Staining in Sections.†— W. B. Leishmann recommends the following method for staining chromatin in sections. The sections (5μ) being fixed in the usual manner, are well washed, after the final alcohol bath, with distilled water to remove all traces of the alcohol, the excess of water being blotted away, and whilst the section is still moist a drop of fresh blood serum is placed on it and allowed to soak into it for 5 minutes; the excess of serum is then blotted away and the remainder is allowed to dry as a film on the section.

A mixture of 2 parts of Leishmann-Romanowsky stain and 3 parts of distilled water is poured on to the section and allowed to stain for 1–1½ hours, the stain being renewed from time to time, and is finally washed off with distilled water. For purposes of decolorisation and differentiation two solutions, freshly prepared with distilled water, are used: (*a*) acid solution, 1 : 500 acetic acid, which removes excess of blue and brightens the red tint of the chromatin; (*b*) alkaline solution, 1 : 7000 caustic soda, which dissolves out the excess of eosin from the

* Bureau Gov. Lab. Manila, No. 31, May 1905, p. 17.
† Journ. Hygiene, iv. (1904) p. 434.

tissue. These two solutions are used alternately, commencing with the acid, the section being frequently observed under a low power until the desired colour contrasts are obtained; the cell nucleus being seen of a deep Romanowsky red colour, and the rest of the tissue pale pink or a light blue; the section is washed in water and rapidly dehydrated, and then mounted in balsam.

Glycogen Staining.* — L. F. Driessen stains the glycogen in animal tissues by the following method. Celloidin or paraffin sections are transferred from alcohol to an alcoholic cochineal solution or to Mayer's carmin solution. They are next treated with 95 p.c. alcohol and absolute alcohol (3 minutes) after which they are placed in iodin-carbol-xylol solution for 3–5 minutes. If overstained, they are washed in carbol-xylol. The preparations are mounted in balsam.

The iodin-carbol-xylol mixture is prepared by placing equal parts of Lugol's solution and carbol-xylol in a test tube and shaking vigorously. Some few drops of the supernatant iodo-xylol are pipetted off and placed on the section, by which it is cleared up and the glycogen stained. The section is then mopped up with blotting paper, and mounted in balsam.

Section Staining by Romanowsky's Method.†—K. Sternberg fixes the material in alcohol and stains the paraffin sections with Giemsa's modification of the Romanowsky method. Immediately before use, the 0·4–0·5 c.cm. of the solution is diluted with 20 c.cm. of boiled distilled water. After a lapse of 20–24 hours the sections are washed in water and differentiated with 0·5 p.c. acetic acid. They are again washed and then treated with alcohol, and finally passed through xylol and mounted in balsam.

Staining and Mounting Ossifying Cartilage.‡ — M. Heidenhain, when demonstrating the ossification of cartilage, fixes, and at the same time decalcifies, small pieces in 5 p.c. trichlor-acetic acid, and after-hardens in absolute alcohol, which must be repeatedly changed. The pieces are imbedded in celloidin, and sections 20–25 μ thick are cut.

The sections are stained with Delafield's hæmatoxylin, and afterwards with borax-carmin. The preparations are best mounted in glycerin jelly made as follows:—Gelatin 45, water 210, glycerin 35, absolute alcohol 70 parts. The gelatin is first dissolved in the water, the glycerin is then added, and the mixture filtered out at a temperature of 56°. To the clear filtrate the absolute alcohol is added drop by drop, the solution being vigorously stirred the while. Air-bubbles may be avoided by fishing the sections out of the warm and liquefied medium, and placing one on a cover-glass and pressing this firmly down on the slide.

Staining the Chromophilous Cells of the Hypophysis cerebri.§—G. Cagnetto gives the following procedure. Fix one half of the hypophysis in 10 p.c. formalin for 3–4 days. Transfer to chromic acid

* Centralbl. allgem. Pathol. u. pathol. Anat., xvi. (1905) pp. 129–31.
† Tom. cit., pp. 293–4.
‡ Zeitschr. wiss. Mikrosk., xxii. (1905) pp. 325–30.
§ Tom. cit., pp. 539–43.

solution 0·1 p.c. for 2 days, and then for 2 days more to 0·25 p.c. On removal wash for a long time in running water. Follow this by graded alcohols to dehydration; xylol; paraffin. The sections, after removal of the paraffin, are to be treated hot for 5–10 minutes with an anilin-water solution saturated with acid-fuchsin. This solution is made by dissolving at a temperature of 70°–80° C. 3 c.cm. of anilin oil in 100 c.cm. of distilled water. When cold, 2 grm. of finely powdered acid-fuchsin are slowly added. After standing for 24 hours and then filtering, the mixture is ready for use. The stained sections are then washed in running water, after which they are differentiated for 4 or 5 minutes with a saturated aqueous solution of picric acid. Differentiation is followed by washing again in running water, then rapid dehydration in absolute alcohol; xylol; and balsam.

This method is very successful for thyroid and pancreas, as well as for the pituitary body.

Intra-vitam Stains for Nervous Tissue.*—A. Leontowitsch finds that Thiopyronin, a rose-coloured pigment with bluish fluorescence, stains Remak's fibres well, and suggests that a combination with methylen-blue might prove useful.

Gentianin and thionin blue, G_7O extra, gave results comparable with those of methylen-blue.

The commercial articles must be purified before use by crystallising out two or three times from hot 90 p.c. ethyl-alcohol.

Stain for Photomicrography.—E. Moffat recommends the following stain for photomicrography: fuchsin 0·06 grm., methylen-blue 0·04 grm., alcohol (90 p.c.) 5 c.cm. Add aqueous solution of carbolic acid 5 p.c., to make up to 25 c.cm. Make films from cultures in the usual way and flood with the filtered stain; warm gently, wash well, dry in air, and mount in balsam.

This solution is a very powerful stain, and used as above gives excellent results with diphtheria, anthrax, cocci, and other bacteria, rendering these organisms very easy to photograph when the film is prepared from a pure culture. The solution when diluted is serviceable for section staining.

New Method of Demonstrating Spirochæta Pallida in Hereditary Syphilis.†—C. Levaditi proceeds as follows. Pieces about 1 mm. thick are fixed in 10 p.c. formalin for 24 hours. They are then washed and hardened in 90 p.c. alcohol for 24 hours. The alcohol is next removed in distilled water, after which the pieces are impregnated in from 1·5–3·0 p.c. silver nitrate. The impregnation is carried out at 38° C. for from 3–5 days. After removal the pieces are washed in distilled water and thereupon placed for 24–48 hours at room temperature in the following reducing mixture: pyrogallic acid 2–4 p.c., formalin 5 c.cm., distilled water 100 c.cm. On removal the pieces are washed, dehydrated in alcohol, and paraffin sections made.

The sections are stained (1) by Giemsa's method and differentiated

* Physiologiste Russe, iv. (1905) pp. 5–8.
† Ann. Inst. Pasteur, xx. (1906) pp. 41–68 (2 pls.).

in absolute alcohol, to which a few drops of oil of cloves are added; they are then cleared up in oil of bergamot and xylol and mounted in balsam; or (2) they are stained with a saturated solution of toluidin blue and differentiated in alcohol, to which a few drops of Unna's ether-glycerin mixture are added. They are then cleared in bergamot oil and xylol, and mounted in balsam.

By this method the spirochaetæ are stained black or almost black. The illustrations show very clearly the effect of the procedure, and also that the organisms are extremely numerous.

(5) Mounting, including Slides, Preservative Fluids, &c.

Clockwork-driven Turntable.—This ingenious instrument, which was exhibited at the November Meeting, 1905, is the invention of A. Flatters and W. Bradley (fig. 36). It is driven by a simple clockwork

FIG. 36.

arrangement, and one of its interesting features is that it is capable of turning rings of any proportions from 0 to 3 by 1¼ in.

On its under surface the turntable has a pair of dovetails, which slide in a dovetail fitting attached to the top of the vertical spindle, rotating with it and causing the turntable to rotate also.

Below the dovetailed fitting is a small steel disk attached to a sliding piece that can be moved to the right or left out of the centre of the vertical spindle by means of long set-screws. The distance the steel disk is moved out of the centre line of the vertical spindle determines the length of the oval. Attached to the under-side of the table are two studs projecting downwards, each having a small roller on its lower end that is in contact with the steel disk. When the latter is moved to the right or left it presses against a roller, and shifts the table out of the

centre to the same extent. The disk also acts as a guide to the rollers, and thus controls the movement of the table.

Standing on the clockwork behind the turntable, and parallel to the front, is a sliding-bar carrying a pointer that can be adjusted to any required position. This pointer acts as a guide for the brush, and the distance the point is placed from the long axis of the oval determines the width of the oval. It is necessary to place the guide for the brush opposite the point at the long axis. An arm-rest is placed in position for the brush-hand.

By the use of this instrument it is possible to run round a needle point or strike a straight line, besides making circles and ellipses. A diamond may be attached to the pointer for cutting cover-glasses.

To set the apparatus to turn any oval :—(1) Let the end of the pointer rest over the centre of the table when it is in mid-position; (2) turn the table half round so that a glass slip is end-on to the operator; then (3) shift the pointer to the right until it is over the end of the short axis of the oval; (4) turn the table back to its original position; (5) decentre the disk on table, moving it to the left by means of the long set-screws until the pointer is over the end of the long axis of the oval.

Mounting Diatoms.*—H. v. Schönfeldt has used syndeticon (the best Norwegian isinglass) with gratifying results. The medium is composed of acetic acid (64 p.c.) 25 grm., syndeticon 4 grm., absolute alcohol 5 grm., isobutyl-alcohol 3 grm. The isinglass is first mixed with the acetic acid and the other ingredients added afterwards gradually. The mixture is then filtered. With a glass rod drawn to a fine point a minute drop of the fluid is deposited on a perfectly clean cover-glass, on which it at once forms a perfectly transparent layer. After the diatoms are oriented it is merely necessary to breathe on the surface of the film. This firmly fixes the Diatoms, and the rest of the procedure is well known.

(6) Miscellaneous.

Measurement of Trypanosomes.†—A. Lingard has adopted the following system for measuring Trypanosomes for a number of years. The fixed points selected between which measurements have been carried out are the following (fig. 37) :—

1. Between the posterior extremity of the parasite and the centre of the blepharoplast.
2. The centre of the blepharoplast to a point corresponding with the posterior edge of the nutritive nucleus.
3. From the posterior to the anterior edge of the nutritive nucleus.
4. From the anterior edge of nucleus to the anterior end of the body.
5. The length of the free flagellum.
6. The maximum width of the body.

* Zeitschr. angw. Mikrosk., xii. (1906) pp. 247–50.
† Journ. Tropical Vet. Sci., i. (1906) pp. 5–14 (1 pl.).

The result of the first five measurements added together give the length of the parasite. For the sake of comparison the mean of each of the above five measurements of *Trypanosomata* of any one species

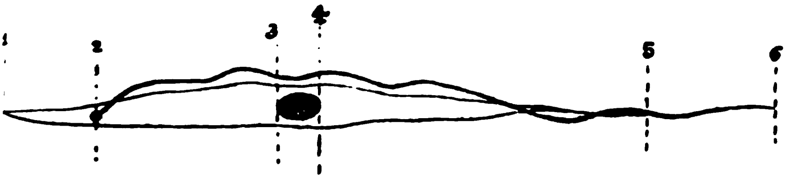


FIG. 37.

are first taken, and then the percentage value of each measurement is calculated, taking the mean total length as 100.

This method affords a basis for the comparison of the various species.

Metallography, etc.

Pressure and Percussion Figures on Plastic Crystalline Metals.*—It is known that figures of definite form, related to the orientation of the crystal, are developed by forcing a sharp point into brittle crystalline substances. F. Osmond and G. Cartaud have employed the same method on metallic crystals. The point of a sewing-needle was pressed by means of a lever into the faces obtained by cutting a crystal of iron in different planes. The pressure employed was 1600 grm. The figures were examined microscopically, and are described by the authors, with diagrams and photomicrographs. The method may be put to practical use in determining the orientation of crystals, sections of which are exposed in a polished metallic surface.

Nickel-Vanadium Steels.†—L. Guillet has examined 32 steels containing 2–30 p.c. nickel, 0·2–7·5 p.c. vanadium, 0·14–1·2 p.c. carbon. He classifies them in six groups: (1) pearlitic; (2) containing carbide and ferrite; (3) martensitic; (4) containing martensite and carbide; (5) containing γ-iron; (6) containing γ-iron and carbide. Vanadium exhibits the tendency, previously observed in vanadium steel, to combine with the carbon, forming a carbide. The effect of vanadium upon mechanical properties is beneficial only in the case of pearlitic steels, in which the maximum tensile stress and elastic limit are raised. The favourable effect is intensified by suitable heat treatment. Addition of vanadium to γ-iron steels diminishes their capacity of resisting shock.

Nitrogen in Steel.‡—In view of the interest aroused by H. Braune's recent researches, translations or reprints of three papers are here given. In the first, by H. Tholander, originally published in 1888, differences

* Rev. Metallurgie, ii. (1905) pp. 811–15 (9 figs.).
† Tom. cit., pp. 870–81 (16 photomicrographs).
‡ Tom. cit., pp. 882–99.

between Bessemer and open-hearth steel are ascribed to the higher percentage of nitrogen in the former. In the second (Boussingault, 1861) methods of estimating nitrogen in iron are given. The third (Allen, 1880) gives some results of analyses. H. Le Chatelier (editorial note) states that the variations in percentage of nitrogen in steel are now proved to be due to the processes of manufacture.

Overheated Steel.*—J. E. Stead and A. W. Richards distinguish between overheating and burning, the former merely resulting in the formation of large crystals, the latter producing incipient disintegration. Three steels, containing 0·06 p.c., 0·48 p.c., and 0·44 p.c. carbon, were selected for the author's researches. One-inch square bars of each were subjected to (1) overheating at 1300° C., (2) reheating after (1) to 880°–950° C.; (3) annealing at 850°–950° C.; (4) sorbitic treatment (0·44 p.c. steel only), which consisted of heating to 900° C., quenching in water, and reheating to 330° C. Mechanical tests (tensile, bending in various ways, and Wöhler reversal of stress tests) carried out on the normal steels and on each steel treated as described, indicated that "overheating reduces the power of the steel to resist fatigue, that reheating such steel more than restores the original good qualities of the rolled bars, and that when the steel has the carbon in the sorbitic condition its power of endurance is more than doubled." Portions of a wagon axle were also heat treated in different ways, the results of mechanical tests indicating that the fatigue-resisting properties of the steel could be greatly increased by suitable treatment. The authors advance the hypothesis that the weakness of overheated steel is due to the presence of large masses of ferrite, a constituent which has a low elastic limit. The good qualities of sorbitic steel appear to be due to the absence of ferrite.

Metallography applied to Foundry Work.†—A. Sauveur recommends a vertical photomicrographic camera. Details of manipulation are given.

The author also describes ‡ the microstructure of cast iron. Rate of cooling probably influences the size of the graphite particles in grey iron.

Corrosion of Condenser Tubes.§—Brass condenser tubes (70 p.c. copper, 30 p.c. zinc) frequently cause trouble through rapid corrosion. A. H. Sexton points out that in tubes which have a short life owing to this cause, the zinc has usually dissolved out much more quickly than the copper. Coarse crystallisation of the brass appears to have no effect on the rate of corrosion. The great variations in the rapidity of corrosion of tubes are not due to any differences in the tubes themselves, but to the conditions to which the tubes are subjected in use. The deposition of carbon or other electro-negative bodies on the surface of the tube sets up electrolytic action and leads to rapid corrosion by the sea water.

The Thermal Transformations of Carbon Steels.‖—The experimental work described in this paper, largely a repetition of that carried

* Iron and Steel Mag., x. (1905) pp. 385–404 (9 figs.).
† Tom. cit., pp. 413–19 (2 figs.).
‡ Op. cit., xi. (1906) pp. 119–24 (4 figs.).
§ Eng. Mag., xxx. (1905) pp. 211–25.
‖ Journ. Iron and Steel Inst., lxviii. (1905, 2) pp. 27–83 (17 pls.).

out some years ago by Osmond and others, was apparently undertaken by the authors, J. O. Arnold and A. McWilliam, with the object of verifying or disproving the conclusions then reached. The three steels employed contained respectively 0·21, 0·89, and 1·78 p.c. carbon, the total percentage of elements present, other than iron and carbon, being very small. The critical ranges of these steels, on heating and cooling, were determined. Samples were heated to different temperatures, quenched, and microscopically examined. By quenching a piece of the 0·89 p.c. C steel when it was passing through the Ac. 1-2-3 change, a section showing both pearlite and hardenite was obtained. Dark etching boundary lines between these two constituents are identified by the authors with Osmond's troostite. The authors give their reasons for declining to accept martensite, troostite, sorbite, and austenite as constituents; they do not object, however, to the terms "troostitic structure," "martensitic structure," etc. In an appendix, definitions of the constituents of steel are given. Fe_3C of cementite and Fe_3C of pearlite are stated to be physically different substances. Excellent micrographs, which have apparently been drawn and not photographed, illustrate the paper.

Important contributions to the discussion were made by J. E. Stead and H. le Chatelier. J. E. Stead expressed the opinion that the evidence in favour of the allotropic states of iron was now overwhelming. The term "eutectoid," as applied to steel of pearlite composition, was to be preferred to "saturated." Martensite, as a homogeneous solid solution of carbon or carbide of iron in iron, should be recognised as a constituent. H. le Chatelier accepted the authors' experimental results as being in harmony with previous observations, but disagreed with some of the theoretical explanations put forward. The alleged insolubility of cementite in hardenite up to 900° C. was improbable. The claim of troostite and austenite to be recognised as constituents is defended. The authors' assumptions as to the constitution of these bodies were purely gratuitous, and not supported by any evidence. The explanation of the separation of graphite in high carbon steel was contrary to well known facts of chemistry. An alternative explanation is advanced. The authors of the paper replied to these criticisms at some length.

The Presence of Greenish-coloured Markings in the Fractured Surfaces of Test-Pieces.*—H. G. Howorth has examined, microscopically and otherwise, a large number of defective test-pieces from gun forgings. The defects were due to the presence of foreign matter, resembling Siemens-Martin slag, usually yellow or green in colour. Two substances, which appear to be sulphide and silicate of manganese, were distinguished in the coloured matter.

The Nature of Troostite.†—C. Benedicks, regarding this constituent as a product of transformation of martensite, dismisses Boynton's hypothesis that troostite is β-iron, as untenable. Troostite appears to be a pearlite with ultra-microscopically small particles of cementite, containing also more or less hardening carbon, and offers an interesting analogy to the colloid solutions.

* Journ. Iron and Steel Inst., lxviii. (1905, 2) pp. 301-19 (13 figs.).
† Tom. cit., pp. 352-70 (2 figs.).

The Influence of Nickel and Carbon on Iron.*—G. B. Waterhouse has investigated the properties of a series of ten steels, containing about 3·8 p.c. nickel, the carbon varying from 0·4–1·83 p.c. Cooling and heating curves were taken, and mechanical tests and microscopic examination were made on the steels heat-treated in various ways. The chief conclusions arrived at are—(1) nickel raises the tenacity of steel without materially lowering the ductility: the elastic ratio is only slightly greater than in carbon steels; (2) cementite of the formula $FeNi_3C$ occurs in these steels; (3) the eutectoid ratio appears to lie at about 0·7 p.c. C.

ANDREWS, T.—**Wear of Steel Rails on Bridges.**
Journ. Iron and Steel Inst., lxviii. (1905, 2) pp. 320–51 (23 figs.).

ARNOLD, J. O.—**The Department of Iron and Steel Metallurgy at the University of Sheffield.**
Tom. cit., pp. 13–26 (14 figs.).

BUMSTEAD, H. A.—**The Heating Effects produced by Röntgen Rays in different Metals, and their Relation to the question of Changes in the Atom.**
Am. Journ. of Sci., xxi. (1906) pp. 1–24 (5 figs.).

CARLISLE, S. F.—**Micrographic Examinatien of Steel, and Construction of Apparatus used.**
[A somewhat elementary account of the apparatus designed and fitted up by the author, and of the micro-examination of various kinds of iron and steel.] *Clarkson Bulletin*, ii. (1905) pp. 14–17 (6 figs.).

DESCROIX, L.—**Abstracts of Papers read at the Metallurgical Congress, Liége.**
Rev. Metallurgie, iii. (1906) pp. 24–47.

DILLNER, G., & A. F. ENSTRÖM—**Researches on the Magnetic and Electric Properties of various kinds of Sheet Steel and Steel Castings.**
[Some interesting photomicrographs of high silicon and aluminium steels are given.] *Journ. Iron and Steel Inst.*, lxviii. (1905, 2) pp. 408–46 (13 figs.).

DUMAS, L.—**Reversible and Irreversible Transformations of Nickel Steel.**
Tom. cit., pp. 255–300 (10 figs.).

GUILLET, L.—**The use of Vanadium in Metallurgy.**
[A summary of the available information on this subject, including a brief account of the author's previously published work on vanadium steel, nickel-vanadium steel, etc.]
Tom. cit., pp. 118–65 (23 figs.).

„ „ **Steel used for Motor Car Construction in France.**
[The properties of numerous alloy steels are reviewed. Excellent photomicrographs illustrate the paper.]
Tom. cit., pp. 166–203 (10 figs.).

„ „ **The Industrial Future of Special Steels.**
Iron and Steel Mag., xi. (1906) pp. 89–95.

LOUGUININE & SCHUKAREFF—**Étude thermique des alliages de l'aluminium et du magnésium.** *Rev. Metallurgie*, iii. (1906) pp. 48–60 (1 fig.).

OSMOND, F.—**Nomenclature of the Constituents of Steel.**
Tom. cit., pp. 101–3.

READ, T. T.—**Cooling Curves of Metallic Solutions.**
Iron and Steel Mag., xi. (1906) pp. 96–9 (3 figs.)

STANSBIE, J. H.—**Solutions of Solids and Solid Solutions.**
Iron and Steel Mag., xi. (1906) pp. 112–19.

TALBOT, B.—**Segregation in Steel Ingots.**
Journ. Iron and Steel. Inst., lxviii. (1905, 2) pp. 204–47 (6 figs.).

* Journ. Iron and Steel Inst., lxviii. (1905, 2) pp. 376–407 (6 figs.).

PROCEEDINGS OF THE SOCIETY.

MEETING

HELD ON THE 21ST OF FEBRUARY, 1906, AT 20 HANOVER SQUARE, W.
DR. D. H. SCOTT, F.R.S., ETC., PRESIDENT, IN THE CHAIR.

The Minutes of the Annual Meeting of the 17th of January, 1906, were read and confirmed, and were signed by the President.

The List of Donations to the Society (exclusive of exchanges and reprints) received since the last Meeting, was read, and the thanks of the Society voted to the donors.

	From
Hardman, W. A. Report to the Government of Ceylon on the Pearl Oyster Fisheries of the Gulf of Manaar. Parts III. and IV. (4to, London, 1905)	*The Royal Society.*
Clarkson Bulletin. Vol. ii. (Potsdam, N.Y., 1905) . .	*The Director of the Thomas S. Clarkson School of Technology*
Warming, Dr. Eug. (Hon. F.R.M.S.) Dansk Plantevækst. (8vo, Copenhagen and Christiania, 1906) . . .	*The Author.*

Mr. Griffiths gave a short account of the method which he had successfully adopted for mounting delicate vegetable tissues in xylo-balsam so as to prevent osmotic action. The specimens were first dehydrated by steeping successively in various strengths of alcohol and subsequently in mixtures of xylol and alcohol. Specimens which were specially delicate were previously fixed with picric acid and after washing a sufficient quantity of this would remain to slightly stain portions. In illustration of the subject an excellent sample of *Spirogyra* in conjugation was exhibited under the Microscope. The precise point at which the staining should be done is determined by the alcoholic strength of the stain.

The President, in moving a vote of thanks to Mr. Griffiths, said he had seen the specimens before the meeting, and was glad to find that the difficulty usually experienced in mounting these delicate objects had been so successfully overcome.

Mr. Beck exhibited and described a new pattern optical bench, for illumination with either ordinary or monochromatic light, the various parts of which, together with the methods of using them, were explained in detail.

Dr. Hebb exhibited an objective intended to be used either as a wet or dry lens, which was designed by Mr. Wenham in 1870, and made by

Messrs. Ross. Descriptive reports on this objective by Messrs. Ross and by Mr. Nelson were read to the meeting.

Mr. A. D. Michael said he perfectly well recollected this lens being brought out, and Mr. Wenham specially selected one for him and seemed to be very proud of it at the time. He had sent it to Mr. Nelson for examination, but neither he nor Mr. Nelson considered it a very great success, and though he still had it he scarcely ever made use of it.

Mr. Walter Rosenhain then described at considerable length a new form of Metallurgical Microscope which, together with various pieces of accessory apparatus, was exhibited to the meeting, a lantern picture of the instrument being shown upon the screen in further illustration.

Mr. Jenkins said that there were several points in which an ordinary Microscope proved inconvenient in the work of examining metal sections, and, so far as he could see, these drawbacks had been successfully overcome in the instrument which Mr. Rosenhain had designed with so much care and skill. He thought that the greater steadiness of the fixed tube would be a great advantage, especially for photography. The qualities of the new Microscope, however, could only be truly appreciated by experience, and he should very much like to have an opportunity of trying the instrument himself in comparison with that he now used. He thought, however, that it would be well to say that if anyone purposed taking up the study of micro-metallurgy, he need not be deterred from doing so by the idea that it was necessary to have any elaborate instruments for the purpose, since very good results could be obtained by a simple means. What they wanted most in micro-metallurgy were objectives which would give them a flat field; but he understood that opticians objected to make these, since the properties which gave flatness of field were, he was told, incompatible with certain other optical properties expected in present-day lenses for general use. The optical firms feared that if they made objectives which would satisfy metallurgists as to flatness of field, their reputation would suffer with those whose work was of a more general nature; but he thought that if they engraved round the objective some such word as "Metallurgical" this would sufficiently explain that it was designed for a special purpose, and their reputation would then be unaffected.

With respect to the optical bench, which was exhibited in conjunction with the Microscope, this was no doubt a very good arrangement, but was it necessary for any ordinary work? In his work he used a Nernst lamp, a simple condenser, and a Beck's cover-glass type of vertical illuminator, and he found no difficulty in getting thoroughly satisfactory photographs up to 1000 diameters.

Dr. Carpenter thought they were very much indebted to Mr. Rosenhain for bringing this instrument before them, and that they ought to recognise that he had attempted, what had not been attempted before, to make an instrument which was perfectly adapted for all requirements of this class of work, which was increasing in importance every year. If the advantages which were claimed for this Microscope were borne out by experience, Mr. Rosenhain had certainly placed

metallurgists under a very great debt of gratitude, and in common with the last speaker he should very much like to have an opportunity of practically testing the merits of the instrument. As regards one point he would like to ask for rather fuller information, and that was in reference to vertical illumination under high powers such as × 1500. In the instruments at present in use they got, on the whole, the best definition with a cover-slip placed in the axis of the tube of the Microscope, but the illumination was not very good. Another method was to have a prism illuminator at the side of the tube, but this, although improving upon the illumination given by a cover slip, was only satisfactory with low powers, because the light was slightly eccentric and it was very difficult to get good definition at high magnifications. If Mr. Rosenhain could give them good vertical illumination with high powers he had certainly achieved a brilliant success.

Mr. Beck said there was one point about this Microscope which rendered it more easy to make a flat field objective, because in this case, the tube length was always the same, and the corrections could be made for this given tube-length. Objectives were corrected for a certain tube length, and if the Rosenhain Microscope be properly used, the image would always be formed at this distance. This being so, it would be possible to produce a lens which would give a flat field in one plane, although there would always be a slight difference between the margin and the centre, and the central definition would have to be slightly impared in quality. In making comparisons of photographs as to their flatness of field, it was of great importance to see that the angle of field included was the same, otherwise such comparisons were valueless. There always would be a limit to the flatness of the field under any circumstances. In the Microscope before the meeting an iris diaphragm had been placed just above the objective by which its aperture could be cut down. This was frequently of great use to increase penetration or depth, and to assist in cutting off internal reflection.

Mr. Rosenhain said he was of course aware that such an instrument as he was exhibiting could only be appreciated by trial, and he hoped that those interested would have an opportunity of trying it; he felt convinced that they would find it much simpler in use than it might appear in the description. As regards flatness of field, he thought that in practice it was a difficulty that was not felt very much, provided the lens were otherwise well connected and that a high eye-piece or a long camera were employed. If it were really found that the want of flatness was a serious matter, it could be overcome to some extent by using not the approximately flat, and frequently slightly convex specimens ordinarily prepared, but specimens deliberately prepared with a slightly concave surface. As regards strictly vertical illumination at 1500 diameters, he did not know if that could be attained with anything but the clear glass disk, but with the silvered half-disk illuminator a very even and practically central illumination could be obtained even with the highest powers, the adjustability of the illuminator especially lending itself to this purpose. The ideal illumination would be with parallel axial light, but when working with a Microscope objective as condenser, it was impossible to obtain parallel light, owing to the spherical aber-

ration arising under such conditions, so that "critical" illumination, with the light converging as nearly as possible upon the centre of the field, was the best available.

On the motion of the President, a vote of thanks was passed to Mr. Rosenhain for bringing this instrument before them, and for so clearly explaining its construction.

Mr. Dollman's paper, on "A Method of producing Stereo-photomicrographs," was read by Mr. Earland, and a number of examples were shown in illustration.

A paper on "A Simple Method of taking Stereo-photomicrographs, and of Mounting the Prints without Cutting," was also read by Mr. H. Taverner, the subject being illustrated by a drawing on the board and by a number of mounted specimens.

Mr. Rheinberg said that, as the hour was late, he would not take time by discussing in detail any matters of theory, as regards stereoscopic effects with the Microscope, but he would like to say that he thought Mr. Taverner's simple and practical method of stereo-photography would be found to be one of much value. Though he thought the reason which led Mr. Taverner to use a circular aperture on one side of the objective, in place of using the whole semi-aperture—as had been done by Mr. Dollman and others before—only in small part accounted for the improved effect, he considered there was a very distinct advantage in this innovation. There was an interesting little point of theory involved in it, which seemed so far to have escaped notice, but which it would not be difficult to substantiate at the right time, and which he was hopeful might be turned to advantage in other directions, as well as the one in question at present.

The President said he had seen some of these photographs, and they were extremely successful and beautiful; he thought they were very fortunate in having heard these two papers.

A vote of thanks was then passed to Mr. Dollman, Mr. Earland, and Mr. Taverner.

Mr. Rousselet said he had received a second list of Natal Rotifers from Mr. Kirkman, amongst which was one new species, *Copeus triangulatus*, specimens of which were exhibited under a Microscope in the room, and a drawing made by Mr. Dixon Nuttall would be published with the paper in the Journal.

Mr. Wesché said he had examined the slide, and found this was a marked new form—the two little processes described showed a thickness of skin approaching to the character of a lorica. It was a very interesting addition to the fauna.

The thanks of the Society were voted to Mr. Kirkman for his paper, and to Mr. Rousselet for communicating it.

The President called attention to an interesting exhibition of Oribatidæ presented by Mr. N. D. F. Pearce, and shown under a number of Microscopes in the room.

New Fellows.—The following were elected *Ordinary* Fellows: Messrs. Jesse Drinkwater, George Reginald Marriner, and Edalji Manekji Modi.

The following Instruments, Objects, etc., were exhibited:—

The Society:—The following slides of Oribatidæ, presented by Mr. N. D. F. Pearce—*Cepheus bifidatus*, *Damæus sufflexus*, *Notaspis pilosa*, *N. sculptilis*, *Nothrus anauniensis*, *N. crassus* var. *Morden*, *N. glaber*, *N. invenustus*, *N. monodactylus*, *N. Targionii*, *N. Tectorum*, *Oribata emissa*, *O. rubens*, *Serrarius microcephalus*.

Messrs. R. and J. Beck:—Optical bench for monochromatic light.

Mr. A. Earland:—Stereo-photomicrographs taken by Mr. William P. Dollman, in illustration of paper by the latter.

Mr. W. Griffiths:—The following slides of stained vegetable tissues mounted in balsam—*Peziza Willkommii*; section of perithecium; asci and spores, stained with osmic acid; *Spirogyra* in conjugation, stained with picric acid and hæmotoxylin, mounted in xylol-balsam; *Zygnema*, stained with hæmatoxylin, mounted in xylol-balsam.

Dr. Hebb:—An Old Dry and Water-immersion ⅛-in. Objective by Ross.

Mr. Walter Rosenhain:—New Metallurgical Microscope and Lantern-Slide of the same, in illustration of his paper.

Mr. C. F. Rousselet:—New species of Rotifer from Natal, *Copeus triangulatus*, mounted specimens, in illustration of paper by Hon. Thos. Kirkman.

Mr. Henry Taverner:—Stereo-photomicrographs, in illustration of his paper.

MEETING

HELD ON THE 21ST OF MARCH, 1906, AT 20 HANOVER SQUARE, W., THE RIGHT HON. SIR FORD NORTH, F.R.S., ETC., VICE-PRESIDENT, IN THE CHAIR.

The Chairman said that before they commenced the business of the evening, he had, with much regret, to announce that since their last Meeting a month ago, they had lost by death their Treasurer, Mr. John Jewell Vezey. He had been a Fellow of the Society for some twenty-seven years, and for many years a Member of the Council, and for the last six or seven years their Treasurer. He was a man who took great delight in science and literature, and was not only a most active and useful and valuable Member of this Society, but also belonged to many others, among which the Royal Institution, the Society of Arts, the British Astronomical Association, the Royal Photographic Society, and the Quekett Microscopical Club, might be mentioned. This would give some idea of his versatility; and he was equally active and energetic in matters connected with the Church and with philanthropic undertakings of various kinds, especially the Miller Hospital, in Greenwich Road, to

which he gave a great deal of time and active assistance—and he was, in fact, there at the time of his death, which took place very suddenly. He was Chairman of the General Committee of that hospital, by which his loss will be very much felt. He was also a very good man of business and universally liked, and was frequently consulted by friends who wished for his advice, and his good common sense and sincere sympathy were ever ready for all. It was said of him that when asked a favour (which is often rather a strain upon friendship) he would do it if he could, and that in a manner which seemed as if he was the person receiving the favour rather than conferring it. All would agree in regretting his loss, an expression of which had been conveyed to his widow by their Secretary on behalf of the Society. His death would leave a gap in many places, which it would be very hard to fill.

The Minutes of the Meeting of the 21st of February, 1906, were read and confirmed, and were signed by the Chairman.

The List of Donations (exclusive of exchanges and reprints received since the last Meeting) was read, and the thanks of the Society were voted to the donors, especially to Messrs. Carl Zeiss for their very valuable presentation of a copy of the collected treatises of the late Professor Abbe.

	From
Webb, W. M. and Sillem, C. The British Woodlice. (8vo, London, 1906)	*The Publishers.*
Winton, A. L. and Moeller, J. The Microscopy of Vegetable Foods. (New York, 1906)	*The Publishers.*
Gesammelte Abhandlungen von Ernst Abbe. Zweiter Band. (8vo, Jena, 1906)	*Messrs. Carl Zeiss.*
Gli Insetti. Vol. i., fasc. 1–13. (4to, Milan, 1906)	*Societa Editrici Libraria, Milano.*

The Chairman announced that the Council had appointed Mr. Wynne E. Baxter to be the Treasurer of the Society, in succession to the late Mr. Vezey.

Mr. J. W. Gordon exhibited and described a new retro-ocular or top stop, which he had devised for the purpose of obtaining dark ground illumination with high powered objectives, and increasing the definition of highly-resolved images in a bright field. He explained that attempts to obtain dark ground illumination in the ordinary way when high powers are used, do not answer because of the wide angles of the high-powered objective, and the necessity, under ordinary conditions, of dark field production for a condenser of wider angle. His new arrangement for getting over this difficulty consisted in placing the stop in the Ramsden circle of the ocular; and if this was accurately adjusted, a satisfactory dark ground could be obtained with an objective of the widest possible angle. The stop was fitted in a small cell which would take stops of various forms and dimensions. When a small stop—less than the Ramsden circle in diameter—was applied, bright field illumi-

nation was obtained with improved definition, so that the contour of blood corpuscles, for instance, could be seen in a way which could not be obtained with ordinary illumination. Accessory mechanism enabled a camera to be fitted to the arrangement. One use of this method was to get a really dark ground with high magnification, but a still more valuable result was the strengthening of the definition in a bright field without reducing the angle, and consequently without loss of resolving power.

On the motion of the Chairman, the thanks of the Society were unanimously voted to Mr. Gordon for the exhibition of his very ingenious contrivance, and for the explanation of it which he had given.

Mr. C. F. Rousselet read a paper entitled, "A Contribution to our Knowledge of the Rotifera of South Africa," illustrating the subject by a large number of lantern slides of the organisms described, and of the localities whence they were obtained, as well as by specimens exhibited under Microscopes in the room.

The Chairman, in moving a hearty vote of thanks to Mr. Rousselet for his communication, said he was sure all present would be glad to join in expressing their appreciation of the very interesting account which Mr. Rousselet had given of his trip to South Africa, and of the excellent photographic illustrations which he had shown to them of the places he had visited.

Mr. Joseph M. Coon exhibited and described a new form of finder, which could be used on any Microscope and with high powers, a special feature of the apparatus being that an object registered on one Microscope could be found on any other. The contrivance was shown in use attached to several Microscopes, and was further explained by drawings on the blackboard.

The thanks of the Society were voted to Mr. Coon for his interesting exhibition and explanation.

Mr. N. D. F. Pearce's paper on "Some Oribatidæ from the Himalayas," was read by the Secretary.

Mr. A. D. Michael said this was a very interesting paper, because we had hitherto known absolutely nothing about the Oribatidæ of Sikkim, and very little indeed of those found in the tropics. The wide distribution of these creatures was very remarkable, considering that they were so very slow moving, living chiefly in mosses and similar kinds of vegetation, for in searching material from various parts of the world, he had generally found British species among them—and in the paper before them there were no widely different types from those found in England at the present day. A less careful observer might have classed many more of them as British species, but the author had picked out minute differences with great skill, although the differences were not in any instance very wide. To get any record at all was very interesting, for Sikkim was a luxuriant and gloriously situated district lying between

our own frontier and the barren wastes of Thibet. He thought it was very good work to get this record of species so curiously resembling our own. Most of them were very small and inconspicuous, and it was rather curious also to notice that most of the tropical species were, on the average, smaller than those found in more temperate climates.

The thanks of the Society were unanimously voted to Mr. Pearce for his paper.

Mr. E. M. Nelson's paper on "The Limits of Resolving Power for the Microscope and Telescope," was taken as read.

The Chairman said this paper would be printed in the Journal, and they felt assured that the results arrived at by Mr. Nelson would prove very interesting on careful perusal, although perhaps rather too technical to be usefully read at a Meeting.

The thanks of the Society were unanimously voted to Mr. Nelson for this communication, and a further vote of thanks to Mr. Pillischer for the loan of a number of Microscopes, was proposed by the Chairman and unanimously carried.

The following Instruments, Objects, etc., were exhibited:—

Mr. Joseph M. Coon.—New finder for the Microscope, and the following slides to exhibit the use of the finder:—Eggs of Sandhopper, *Equisetum arvense*, growing point of barren stem, human ovary, micropyle of embryo of ovary of lily; photomicrographs.

Mr. J. W. Gordon:—Retro-ocular or top stop for use with high powers.

Mr. C. F. Rousselet:—Lantern slides, and the following Microscope slides of South African Rotifers, etc., in illustration of his paper:—Rotifera various, from Alexanderfontein, Kimberley; *Brachionus furculatus* ♂ ♀ and *B. furculatus* var. *inermis*, without spines, from Koorn Spruit, Orange River Colony; Desmids, Diatoms, and *Ploesoma lenticulare*, from railway water tank, Norton, Mashonaland; *Brachionus pala* var. *dorcas*, from Bulawayo Waterworks; *Pedalion mirum*, and *Tetramastix opolensis*, from Matapos, Rhodesia; Desmids, Diatoms, *Brachionus angularis* var. *caudatus*, *Polychætus Collinsi*, and various other Rotifera from Victoria Falls, Zambesi River; *Lacinularia racemovata*, from Rhodesia.

New Fellow.—The following was elected an *Ordinary* Fellow: Mr. Herbert Bibbey.

// JOURNAL

OF THE

ROYAL MICROSCOPICAL SOCIETY.

JUNE, 1906.

TRANSACTIONS OF THE SOCIETY.

IV.—*A Simple Method of Producing Stereo-Photomicrographs.*

By W. P. Dollman.

(*Read February* 21, 1906.)

Plate VIII.

I will endeavour to put in as concise a form as possible the principal points in the production of the stereo-micrographs that will be shown this evening. The method is very simple. I have made a hobby of stereoscopic photography since 1865, and as well have handled many Microscopes, optical work being always an attraction to me.

Some twelve or more months ago a friend called my attention to an article on stereo-photomicrography in the "British Journal of Photography Almanac" for 1894, by the then editor, the late Mr. J. Traill Taylor, who therein explained several methods of producing stereograms of microscopic objects. I adopted what I thought the simplest method, that of obscuring by a semicircular shield half of the objective in use. I had a cloth-lined brass tube with one end half screened (blackened, of course), made to slip over the lens, and to revolve smoothly on the mount. As the objectives vary in diameter, the tube was made to fit the widest one, and strips of cardboard were cut to make the tube fit the smaller ones.

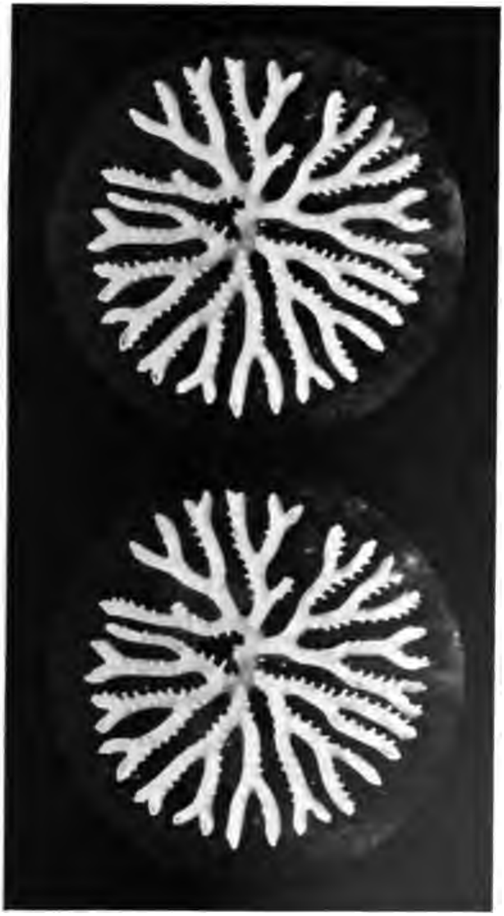
In the case of photo-objectives—I have used these from 2-in. to 6-in. focus—a semicircular shield of thin blackened brass can be dropped against the diaphragm between the combinations, and this is certainly the better place for the screen. I have used a 2-in. Dallmeyer portrait combination (which is specially good for

this work), a $4\frac{1}{2}$-in. Unar, and a 6-in. Goerz. I use a f 5·6 diaphragm with the Dallmeyer, that of f 8 with the Unar, and f 8 with the Goerz.

Of course, for low magnifications of a rough object it is advisable to work with a low power—the $4\frac{1}{2}$-in. focus lens was used for most of the prints exhibited—but for larger objects a 6-in. lens would define better. The little Dallmeyer lens is a marvel for definition and flatness over the small field used.

I have had extra tubes made for my Microscope (a Van Heurck by Watson) to take the place of the lower rackwork tube and the upper sliding tube, which carry the photo lenses—the Dallmeyer at the bottom of the draw-tube, the Unar (for which I had a new mount made so as to get it inside the tube), about $1\frac{1}{2}$ in. down the tube from the top, and the Goerz outside on the eye-piece end of the Microscope. These adaptations enable the lenses to be carried at the suitable distances from the object on the stage, and allow sufficient rackwork for focusing. When the distance is too great (as it will be in low-power work) for the hand to reach the focusing pinion, I have to use a Hooke's joint focusing rod, but for the higher powers I have a long rod on the other side (the right) of the camera with a pulley wheel near the end, over which and the fine-adjustment screw-head runs a cotton thread-loop, which I find quite effective for monocular work, even with a $\frac{1}{12}$ objective.

The camera I use is a whole plate one, with a long bellows, and for long-distance work a telescopic attachment in front (made of rolled brown paper). The upright position of the plate in the camera is the more convenient for photographing opaque objects requiring to be lighted from the front and side, and in this case the objective should be divided horizontally. For transparent objects lighted centrally from the back, the plate may be horizontal, and the lens divided vertically. I effect the reversal of the images on the plate—so that the prints will not require to be cut, and so simplify the mounting—by using a carrier in the dark slide (the whole plate slide allows this to be done) in which the plate (5 by 4 in.) can be placed $2\frac{1}{4}$ in. out of centre, so as to receive the image from the right hand (or upper) half of the lens on the left hand (or lower) half of the plate. The opening in the carrier should be $7\frac{1}{4}$ in. by 4 in., a piece of glass $2\frac{1}{4}$ in. by 4 in. filling the otherwise unoccupied end. A screen (of blackened card or thick paper) with an aperture in the centre of $2\frac{3}{8}$ in. by 3 in. should be placed in the carrier, to protect one half of the plate while the other is being exposed. After exposing one side of the plate, the slide is taken into the dark room, and the plate moved to the other end of the carrier. Then the screen on the objective is moved half round (or, in the case of a lens in the draw-tube, the tube is given a semi-revolution without disturbing the focus), and the second exposure can be made.



POLYZOA (IDMONEA RADIANS).

W. P. Dollman, Phot.

An important thing to remember when photographing opaques, is that, to secure even illumination of the two halves, the illuminant must be on the same level as the centre of the objective. For the lighting of large transparent objects, when using the 4½-in. and 6-in. objectives, I have had a cell, which carries a 4½, 6, or 8-in. focus uncorrected condenser, fitted to the large aperture under the main stage of the Microscope, and brought as near as possible to the object. For the smaller objects I use an achromatic condenser of 1·0 N.A. This can be altered in power by removing the top combination, or, if necessary, using only the lower of the three lenses. As illuminant, I use acetylene (the finest light for all ordinary work), from a special burner I had made, limelight, and sometimes sunlight (parallel rays), through a heat-absorbing medium. On the platform carrying the apparatus I have marked a scale from 0 to 49 in., with the zero at the level of the Microscope stage. This, with the aid of tables for the various lenses used, enables me to work to definite magnitudes, and also to calculate approximately the focus of all objectives that can be used without an eyepiece.

By the way, low power micro-objectives are almost invariably very wrongly named — a nominal 3-inch being only 2·3-inch, a so-called 2-inch only 1·5, and so on. I do not think I need say anything about exposure, as that depends upon colour or brightness of object, illumination and magnification. I use ordinary developers, such as would be suitable for landscapes, using such as would give hard results to accentuate feeble contrasts. Chromatic plates, with or without a yellow screen, are used, and where suitable a malachite green light filter when monochromatic light is desirable. A good deal of my apparatus is makeshift—that is, diverted from other uses—but is effectual. My optical outfit is of the best, both in low and high powers, condensers, etc.

In this description I fear I have been rather diffuse, and have detailed a lot that perhaps everybody knows all about; but I thought it expedient, owing to my great distance from the place where this will be read, to be a little particular.

I ought to have mentioned before, but forgot till I thought I had finished, that (as the major conjugate focus is being used) all non-symmetrical photographic lenses, such as "Unars," "Stigmatics," and portrait combinations, should be reversed on the Microscope (the front combination being presented to the plate), to enable them to perform at their best.

North Adelaide,
South Australia.

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V.—*A Simple Method of taking Stereo-Photomicrographs, and Mounting the Prints without Cutting.*

By H. Taverner.

(*Read February* 21, 1906.)

Plates IX., X. and XI.

In November 1903 I had the pleasure of exhibiting to the Fellows of this Society two photographs of the hairs on the leg of a water-mite, which I had taken through the right and left tubes of a binocular Microscope, in order to demonstrate that the two images were not identical. I did not bring the matter forward as a new discovery, but simply because the object was particularly suited to demonstrate the fact, which I knew was disputed by some microscopists. The photos in question were too small to be viewed stereoscopically, and I therefore exhibited under a stereoscope at the same time two photos of the same subject, taken by a different method with a magnification of over 200 diameters, which proved that the two dissimilar images combined to form a stereoscopic picture. The method then adopted for the production of the photos was to cover the front of the objective with a cap (fig. 38), by means of which exactly one half of the front of the lens was cut off. The rotation of this cap through 180° allowed separate pictures to be taken by the right and left halves of the lens.

I did not pursue the matter further at the time; but shortly before Christmas last I wanted a similar photo for a friend, and it then occurred to me that the axial rays of light were detrimental to the formation of a stereoscopic image, and that if I could stop them out, I should obtain better results stereoscopically than by my former method. I therefore tried the experiment of cutting out all the central rays of light by means of a stop placed behind the objective, having a circular aperture, so situated that its inner edge was outside the optic axis of the lens (fig. 39). The resulting photos were a decided improvement on those obtained by my former method; and on showing these to Mr. Rheinberg, he confirmed me in my intention of experimenting with stops of smaller aperture.

I do not think I need say anything further on this point,

EXPLANATION OF PLATE IX.

Water-mite (*Ecpolus papillosus* Soar) female. × 30. Collected and mounted by H. Taverner. Photographed with a 2·5 mm. stop. Beck's 1½-in. objective and No. 1 eye-piece.

WATER-MITE (ECPOLUS PAPILLOSUS, SOAR).

H. Taverner, Phot.

FORAMINIFERA (ORBULINA UNIVERSA)

H. Taverner, Phot

except to mention that all the photographs on exhibition to-night were taken with stops having circular apertures of 2½–4 mm. in diameter, and with the inner edge of the aperture in no case more than 1 mm. from the optic axis of the lens. It will be found necessary to vary the size of the aperture in the stop according to the thickness of the object to be photographed, and the objective in use; but the best results, without distortion or exaggerated stereoscopic relief, are to be obtained by the use of a stop having—

1. The largest possible aperture that will give sufficiently sharp detail in the picture.

2. The inner edge of the aperture as near the optic axis of the lens as will give sufficient stereoscopic relief, and at the same time the truest appreciation of the thickness of the object, or third dimension.

For convenience in working, Mr. Curties has made for me a small piece of apparatus which screws into the nose-piece of the

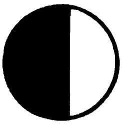

Fig. 38.

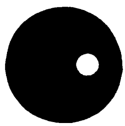

Fig. 39.

Microscope, and is itself of the nature of a secondary nose-piece, to facilitate the changing of the stops. It is fitted with a swing-out arm, carrying a ring which holds the stops, and which revolves through 180° exactly, thus changing the aperture in the stop from one side of the optic axis to the other, for the purpose of making the two exposures. Except for this revolution of the stop, the two photos are taken without any alteration whatever in focus, illumination, position of object or apparatus, except, of course, the dry plate.

To obtain the two pictures on one plate in the correct position for printing and mounting without cutting, I use what is known as a repeating back, a specimen of which is exhibited here this evening. One picture is taken at a time, that on the left half of the plate, with the aperture in the stop to the left of the optic axis, and that on the right half of the plate, with the aperture in the stop to the right of the optic axis. The images are now on the negative in the correct positions for printing and mounting, with-

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EXPLANATION OF PLATE X.

Foraminifera (*Orbulina universa*), showing internal Globigerine structure. × 25. Mounted by Mr. A. Earland. Photographed with a 2·5 mm. stop. Beck's 1½-in. objective and No. 1 eye-piece.

out any further trouble. This description is correct for the $\frac{1}{2}$-inch objective, and all lower powers used with an eye-piece, but may, possibly, have to be reversed with higher powers.

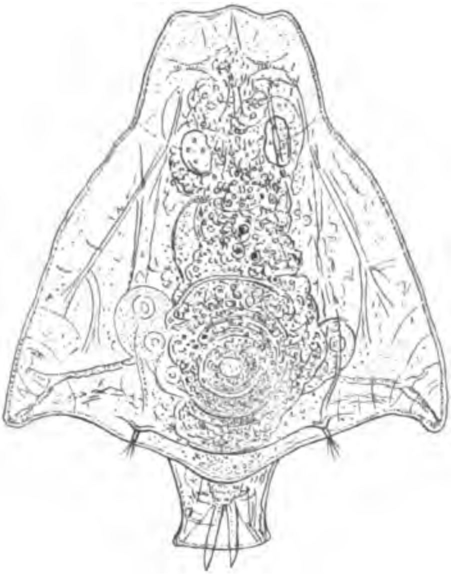
In conclusion, I should like to add that particular care must be taken in fitting the nose-piece, so as to secure the true horizontal alignment of the apertures when the stop is revolved from one side of the optic axis to the other. If the apertures are not truly aligned, the finished prints will not superimpose properly, and will not be clear and sharp. I may, perhaps, also mention that my only trouble has arisen from a difficulty in obtaining equal illumination of both pictures with transparent objects by transmitted light, but as my photos have been taken without an optical bench, this difficulty may not arise when one is used.

EXPLANATION OF PLATE XI.

Foraminifera. Various species from Timor Sea, 50 fathoms. × 25. Mounted by Mr. A. Earland. Photographed with a 4 mm. stop. Beck's $1\frac{1}{2}$-in. objective and No. 1 eye-piece.

FORAMINIFERA FROM TIMOR SEA.

H. Taverner, Phot.



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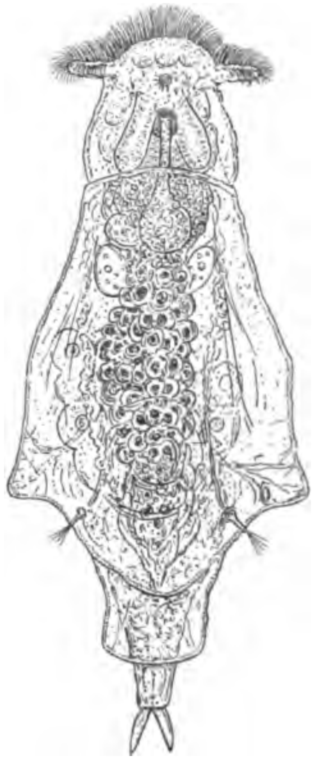

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F.R.Dixon-Nuttall del.ad nat. West,Newman lith.

Copeus triangulatus

VI.—*Second List of Rotifera of Natal.*

By Hon. Thomas Kirkman, M.L.C., F.R.M.S.

(*Read February* 21, 1906.)

Plate XII.

In January 1901* I sent to the Royal Microscopical Society a list of Rotifera found by me in Natal up to that time, enumerating 52 species.

Continuing my observations at various times when opportunity served, I have now to submit a further list of 20 species, amongst which one at least, *Copeus triangulatus*, is an interesting new species.

Rhizota.

Floscularia coronetta Cubitt.—This was found in considerable quantities on the tips of grass roots in a pool of the Umzinto river, during 1901. It agreed in all respects with the description given by Hudson and Gosse.

Floscularia ornata Ehrenberg.—I found this in company with *Lacinularia*, November 1904, in small numbers.

Œcistes longicornis Davis.—What appeared to be this, was found in January 1904, in a dam on the Equeefa river, on grass roots in small quantity. It had the long recurved antennæ and the tube as illustrated by Hudson and Gosse.

Lacinularia socialis Ehrenberg.—This was found in November 1904, on stems, etc., and roots of grass in Umzinto pools.

Megalotrocha semi-bullata Hudson.—There were considerable numbers of this during the years 1902–3 in pools of the Umzinto. I looked for the muscles that caused the contractions, but could not find any of the usual striated muscles as are seen, say, in *Pterodina*; but under a 4 mm. of Zeiss, I saw what I took to be muscles acting in a spiral manner, like the threads of the common *Vorticella*. I had three under view in the same field, and watched them coil in a spiral manner as the animal retracted its head, and uncoil again as the animal became fully extended. The animals do contract slightly below the trifid knob, and, in case of a sudden and great alarm, have the power to retract within themselves both their head and foot absolutely and completely, when they present the appearance of minute little kegs or casks, the circular muscles looking like distended elastic hoops. This species cannot be

* See this Journal, 1901, pp. 229–41.

correctly described as fixed clusters, in the same sense that *Lacinularia* is fixed, although it does affix itself to objects, including the side of the glass bottle. It swims freely in the water as a cluster, and can be gathered in numbers by merely plunging a bottle in the water amongst them. I sent two or three clusters to Mr. Rousselet for identification.

Ploima Illoricata.

Triarthra longiseta Ehrenberg.—What was clearly this was found in pools in the Umzinto in January 1904.

Notommata saccigera Ehrenberg.—I found a few specimens only of what I supposed was this in February 1902. I could not be quite certain about it.

Notommata collaris Ehrenberg (not Gosse).—I sent home to Mr. Rousselet in June 1904 a few specimens of a Rotifer that I could not identify, but which he told me were Ehrenberg's *Notommata collaris*—not the species Mr. Gosse has described under that name. They were found in marshy places near Maritzburg, in company with *Copeus spicatus*, and also with another *Copeus* that is considered to be new.

Copeus triangulatus sp. n. (Plate XII., figs. 1, 2).—In June 1904 I sent to Mr. Rousselet two or three specimens of an unknown *Copeus* (to me at least), along with the specimens just mentioned of *Notommata collaris*; but they were contracted, and, although of a peculiar form, he was not able to identify them. In June 1905 I tried again to preserve some specimens in a more extended condition, that I might be able to send to him for identification. I also mentioned them to him when he was in Maritzburg with the British Association in August of that year. I understand now from him, since he has had an opportunity of examining the extra specimens, that he has no hesitation in pronouncing them to be a new species of *Copeus*, for which he has suggested the name *C. triangulatus*, and Mr. Dixon-Nuttall has been good enough to draw the excellent figures illustrating this paper.

The most conspicuous feature of this fine new *Copeus* is the shape of the body, the integument of which is expanded in the lumbar region into three large, broad, pyramidal humps, one on each side and the third on the dorsal side, so that a transverse section of the body in this region forms an equilateral triangle, the

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EXPLANATION OF PLATE XII.

Fig. 1.—*Copeus triangulatus*. Dorsal view. × 130.
" 2. " " Contracted. × 165.

flat ventral side of the body forming the base. When swimming in the water the humps are more or less retracted; when crawling on weeds or on the sides of the bottle they are more prominent, but they shoot out quite rigid every time the creature contracts its head.

In size and bulk the new *Copeus* equals *C. Ehrenbergi.* It has two prominent ciliated auricles, somewhat smaller than those of the species just named, extruded when swimming, but otherwise withdrawn. The ciliated face extends some distance on the ventral side, but does not form a projecting lip. The integument above the foot is ample, and forms there angular folds not unlike those of Ehrenberg's *Notommata collaris*; the foot is comparatively small, and carries two short, tubular toes; there is no tail.

The stomach is spacious and usually full of dark green food material, and occupies the greater part of the dorsal hump.

The lateral antennæ consist of bundles of long setæ protruding from tubules on the dorso-lateral sides of the lumbar region and behind the humps.

The head is distinctly marked off by a fold of the integument, and in contraction is wholly withdrawn within this fold.

The peculiar organ usually designated as "brain-sac" is three-lobed; the central lobe is very long, clear, and saccate at its termination, extending right down over the anterior part of the stomach; the two outer lobes are short, cylindrical, and granular. The large red eye, which contains a spherical red lens, is situated on the small real brain below the "brain-sac," and just in the angle formed by the two outer lobes.

The ovary is band-shaped and curved like a horseshoe.

Two of the narrow transverse muscular bands have their points of attachment within the two lateral humps, and are also fixed in the dorsal hump, so that their contraction draws in all three humps simultaneously.

On being placed in a bottle of water, its habit is to cling to some piece of floating matter, and it is seen with difficulty or not at all. When it swims, it is seen at once by its auricles being extended. It acts in quite a different way from *C. spicatus*, which on being disturbed casts itself free from all matter, goes with the currents, not swimming, trusting to its transparency for protection. In one or two or more days after *C. triangulatus* has been placed in a bottle, when the sediment has completely settled, it will be noticed at once from its curious pointed lateral extensions, apparently feeding just above the sediment, or crawling along the sides of the bottle.

The cilia round the mouth-part can only just be discerned whilst in motion, when the animal is fully extended. This *Copeus* appears to be more sluggish in its habits than any other species that I have seen. I am sorry to say that I have not examined the

jaws or teeth—there were so few of them that I was afraid each one might be the last, and did not like to destroy one.

Near Maritzburg this *Copeus* was much infected with a parasite, although *C. spicatus* and other Rotifers living in the self-same water were perfectly free from it. Mr. Rousselet tells me that this parasite is well known to him, being the same kind of sporozoon that often infests *Synchæta pectinata.*

The measurements of *C. triangulatus* show the following values for the largest specimens: total length, expanded, $\frac{1}{38}$ in. (669 μ), width $\frac{1}{72}$ in. (346 μ); of contracted animal, length $\frac{1}{58}$ (438 μ), width across the hump $\frac{1}{69}$ in. (369 μ).

Copeus pachyurus Gosse.—I have seen this on the coast near home during the years 1901–2. This is the fifth *Copeus* now found in Natal. With the kind assistance of Mr. A. W. Cooper, of Richmond, I was able to send to Mr. Rousselet in 1904 some specimens of *C. spicatus*, mentioned in 1901. In 1905, I also sent him two specimens, with auricles fully extended, of what he says are *C. cerberus* and *C. Ehrenbergi*, both of which I mentioned in my previous list, 1901.

Eosphora digitata Ehrenberg.—In March 1904 I sent to Mr. Rousselet a few specimens of two *Eosphoras* for identification. One he told me was *E. digitata* and the other *E. elongata.* This one, *E. digitata*, was the most savage and carnivorous Rotifer that I have yet seen, a cannibal of the most degraded stamp. In February 1902 I found one which had four sets of teeth in its stomach.

The teeth were all of one description, namely of the *Philodina* type. On March 15, 1904, I saw one that was in a watch-glass, with others of the same species, attack one of the others and hold on with its teeth till its victim was disabled; it would not let go even when I tried to separate them with a bristle.

On the 16th, that is the next day, I have another entry in my diary, "*Eosphora digitata* is very savage, attacking various things in the water, as worms, infusoria, and its own kin."

Eosphora elongata Ehrenberg.—This was one of the species sent with the above and identified by Mr. Rousselet as *E. elongata.*

Diglena grandis Ehrenberg.—I mentioned in 1901, in a note at the end of my list, that one specimen of this had been found. Since that time, both in 1903 and 1904 in the warm summer months, I have seen other specimens, but not in quantity. Hudson and Gosse speak of the teeth of these animals as being "bristle-like" and also as being "arranged in double rows."

A statement like this, coming from such an authority, has caused me to examine several times in various media the trophi of this *Diglena.* My examination amounts to this:—

That, viewed under a low power, that statement seems to be correct, but, viewed under a 4 mm. of Zeiss apochromatic, the bristle-like appearance of the teeth vanishes, and so also does the double-

row arrangement. The appearance of each tooth then becomes something like a carpenter's small chisel with a blade and a short narrow shank. The blade stands about half its length above the socket, and close to the jaw-bone as it were, stands out clearly the short narrow shank.

The division of the blade part of the tooth, standing half in and half out of the socket apparently, causes the appearance of there being two rows of teeth: at least, that is my impression.

Loricata.

Rattulus rattus Ehrenberg.—What I concluded was this, I found in December 1903, on the coast near home, clinging to the stems of our blue water-lilies.

Diaschiza gibba Ehrenberg.—A few specimens that seemed to comply with Hudson and Gosse's description and illustration of *Furcularia gibba*, now transferred to the genus *Diaschiza*, were found in a slow moving pool of the Umzinto in November 1904. I have not come across it again since. According to Dixon-Nuttall, Gosse's *D. semiaperta* belongs to the same species.

Metopidia oxysternum Gosse.—For a short time this was seen in great numbers in pools near home, September 1901.

Brachionus angularis Gosse.—In a small pool on the rocks with the water discoloured by unicellular algæ. This was found by Mr. Tyrrell and myself, September 1902.

Anuræa aculeata var. *curvicornis* Ehrenberg.—I found this near Maritzburg in 1902 and again on the coast in 1904. One specimen was sent in a slide along with some *A. valga* and identified by Mr. Rousselet.

Anuræa aculeata var. *valga* Gosse.—I sent one or two specimens of this, which was found by Mr. Tyrrell and myself in October in one of the pools of the Umzinto, to Mr. Rousselet for identification in December 1904. He said it was *A. valga*. We found that there were seven teeth in each uncus—not five, as mentioned in Hudson and Gosse.

Anuræa cochlearis Gosse.—This was seen in small pools in the Equeefa river in 1901 during November.

Note.

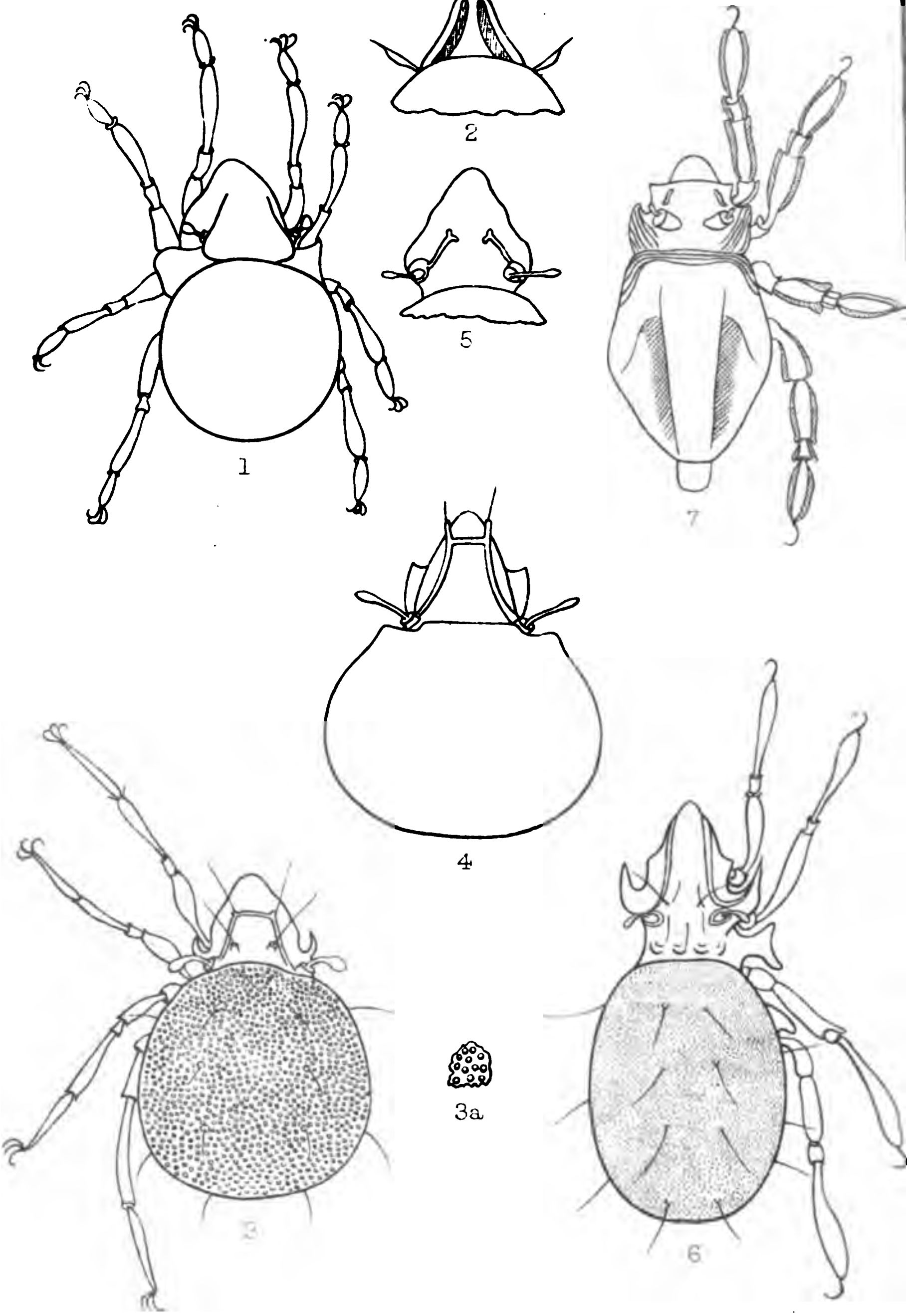
Pterodina trilobata Shephard.—In the Journal of the R.M.S. 1901, on page 241, Mr. Rousselet refers to the mounted specimen I had sent to the Society in these words:—"Lateral canals and vibratile tags could not be found in the mounted specimen, but near the base of the stomach on each side I observed a cluster of

peculiar organs looking like flagellate cells, the nature of which I cannot determine, if they do not belong to the water vascular system."

I have since that time found them in the living animal.

I wanted to find out whether these flagellate cells acted in unison with any other portion of the organism, and whether the movements were uniform and constant or otherwise. The motion of the foot from side to side prevented any satisfactory examination, but this much was clear, that the movements of these cells were similar to those of vibratile tags, and I would say strikingly so.

The Rotifer described as *Mastigocerca carinata* in my last paper, with a double ridge nearly half way down its back, I now see is *Rattulus mucosus* Stokes, according to Professor Jenning's Monograph of the Rattulidæ.



C. Warburton del ad nat West, Newman lith.

Oribatidæ from the Sikkim Himalaya

VII.—*On some Oribatidæ from the Sikkim Himalaya.*

By N. D. F. Pearce, Cambridge.

(*Read March* 21, 1906.)

Plate XIII.

Early in February I received from Mr. A. Gage, Superintendent of the Royal Botanic Gardens, Sibpur, several parcels of moss collected on the Sikkim Himalaya range at altitudes varying from 8000–2000 feet. These I carefully examined for *Acarina*, especially *Oribatidæ*. So little is yet known concerning the distribution of this family in other continents than our own, that the results seem to me worth putting on record.

Of 20 species distributed among 12 genera no less than 12 were British; in some cases there were slight variations from our own types, but as most of these creatures vary within rather wide limits I did not consider such minute distinctions of specific importance. I have appended a few notes on these points to the list which follows.

Sub-family **Oribatinæ.**

Genus *Pelops.*

1. *P. acromios.*—Differs slightly from type in marginal notogastral hairs, which are longer and less spatulate than in our form. Living. Baghghora, 6000 ft.

Genus *Oribata.*

2. *O. oralis.*—Chitin unusually massive. Nymphs with clavate notogastral hairs strongly developed. Plentiful, living and dead. Baghghora, 6000 ft.

3. *O. alata* var. major.—Very much larger than ours (1200 μ). No small specimens found. Radiating tubes in chitin of pteromorphæ conspicuously shown in dissections. Plentiful, living and dead. Sinihul, 8000 ft. Darjiling, 6500 ft. Baghghora, 6000 ft.

Sub-family **Notaspidinæ.**

Genus *Cepheus.*

4. *C. ocellatus.*—A single specimen, dead and broken. Baghghora, 6000 ft.

Genus *Liacarus.*

5. *L. palmicinctus.*—One nymph, not quite full grown. Sinihul, 8000 ft.

Genus *Notaspis.*

6. *N. tibialis.*—Plentiful, living. Baghghora, 6000 ft.
7. *N. similis.*—Plentiful, living. Baghghora, 6000 ft.

Genus *Tegeocranus.*

8. *T. velatus.*—Living. Darjiling, 6000 ft.

Sub-family **Nothrinæ.**

Genus *Hermannia.*

9. *H. convexa.*—Living. Sinihul, 7500 ft. Baghghora, 6000 ft.
10. *H. bistriata.*—One, dead. Baghghora, 6000 ft.

Genus *Cymbaeremæus.*

11. *C. cymba.*—One, living. Sinihul, 8000 ft.

Genus *Nothrus.*

12. *N. tectorum.*—Living. They appear very tenacious of life; they were in very dry material. Darjiling, 6000 ft. Baghghora, 6000 ft. Sukvar, 4000 ft.

All the above are British. The following are, I think, unrecorded:—

Sub-family **Oribatinæ.**

Genus *Oribata.*

13. *O. fallax* sp. n.—Yellow-brown, smooth, not polished. Cephalothorax, blunt. Lamellæ, narrow blades on edge, no cusps, not any translamella. Abdomen broadly piriform, rounded posteriorly, hairless. Pteromorphæ very small, almost obsolete; they barely extend between the second and third pair of legs. Pseudostigmatic organs shortish, with thin peduncles and almost globular heads. Legs rather long, no blades to any joints. Claws tridactyle. Size 450–470 μ. Many, living and dead. Baghghora, 6000 ft. Darjiling, 6000 ft. Sukvar, 4000 ft.

This species comes near to *O. cuspidata* and *O. lucasii*, and may readily be confounded with *Notaspis tibialis*, a species not having any true pteromorphæ, but with projecting anterolateral corners of abdomen—"pteromorphulæ." Dissection, and consequent loss of the specimen, is sometimes the only reliable test.

Sub-family **Notaspidinæ.**

Genus *Liacarus.*

14. *L. nigrescens* sp. n.—A large species, black, polished. Resembles *L. globosus*, but is certainly not so spherical. Pseudostigmatic organs sessile, like those of *L. coracinus*. Lamellæ

distinctive; they are thick blades on edge, widest apart posteriorly, narrower and closely approximate anteriorly; they do not touch, however. Lamellar cusps short, rounded, not any central mucro. Size 1300 μ. Baghghora, 6000 ft.

Genus *Chaunoproctus* g. n.

Apterogasterinæ, with cephalothorax anchylosed to abdomen, divided from it by an unbroken line. Abdomen broadly piriform, areolated or rough. Cephalothorax shortly pyramidal, with lamellæ (and translamella) which are thin blades on edge. Legs long and thin, not clavate or moniliform, femora of first pair with thin peduncles. Claws tridactyle in all known species.

This genus appears to be most nearly related to *Cepheus*; in some points it resembles *Tegeocranus*.

15. *C. cancellatus* sp. n.—Dark brown, texture pitted or areolated; shape broadly piriform. Cephalothorax small in proportion, with lamellæ, which are narrow bars extending two-thirds of the length of the cephalothorax, slightly converging and joined by a translamella, which is a similar bar. Not any lamellar cusps. Lamellar hairs long and fine. Pseudostigmatic organs shortish, with thin peduncle and moderately clavate head. Abdomen almost spherical, truncated anteriorly, a few long hairs on notogaster, and round posterior margin. Legs, especially 1 and 4, very long, femora of first pair with thin peduncles. Claws tridactyle. Genital and anal plates large, near together. Size 720 μ. One, dead. Baghghora, 6000 ft.

16. *C. asperulus* sp. n.—I unfortunately found only broken specimens, which, however, I have no hesitation in referring to this genus. Most of the preceding description holds good.

Differences.—Texture rough, very slightly pitted. Lamellæ broader, extending further down the cephalothorax, and with long cusps standing free beyond the translamella. Pseudostigmatic organs longer, almost rod-like, but slightly enlarged distally. Size 840 μ.

A nymph, probably of this species, occurred: it greatly resembles the adult. Darjiling, 6500 ft. Baghghora, 6000 ft.

Genus *Notaspis.*

17. *N. hamatus* sp. n. — A small species of the *splendens* type: it greatly resembles this in general appearance. The lamellæ are characteristic; they arise near the pseudostigmata, and converge anteriorly at an acute angle; they do not meet. The anterior ends are sharply recurved, and where they curve there is a short, blunt cusp, looking upwards, from which the lamellar hair springs. Pseudostigmatic organs shortish, with large, clavate heads. Size 300 μ. One, living. Darjiling, 6000 ft.

Sub-family **Damaeinæ.**

Genus *Amerus.*

18. *A. speciosus* sp. n.—Light brown, smooth, minutely granulated. Pseudostigmata moderately wide apart. Pseudostigmatic organs shortish, recurved, clavate. Interlamellar hairs long, setiform. Lamellæ start from pseudostigmata and turn inwards, then run parallel nearly the whole length of cephalothorax. They inclose upon it, so to speak, a high plateau, which slopes down and broadens out considerably posteriorly for the insertion of the first pair of legs. On this plateau there is a curious long triangular mark, its base towards the abdomen; it extends halfway down the cephalothorax, and at about the middle of its sides the interlamellar hairs arise from small apophyses. A pair of long, curved hairs (? rostral hairs) arise below the lamellæ near their anterior end. Abdomen long, rounded posteriorly, with two rows of long, setiform, dorsal hairs, and a similar sparse marginal row. Chitinous projections at side of body between legs 1, 2; 2, 3; 3, 4; the second much the largest: it is sub-triangular, apex of triangle inwards. Legs long and thin, tibia and tarsus especially looking laterally compressed. Claws large, monodactyle. Anal plates large, remote from genital, which are smaller. Size 1300 μ. Two, living. Baghghora, 6000 ft.

Sub-family **Nothrinæ.**

Genus *Neoliodes.*

19. *N. ocellatus* sp. n.—Dark brown, rough, dull. Shape roughly hexagonal. Cephalothorax broadly pyramidal, with a few indistinct markings. Pseudostigmata characteristic; they open upwards and sideways, but the whole organ is seen, as it were, in optical section, and the appearance is that of an irregular ovoid, nearly at right angles to the median line, the smaller end being inwards. Pseudostigmatic organs small, projecting, with thin peduncles and clavate head. Abdomen pentagonal, with a rounded projection at posterior extremity—this is a portion of the cast larval or nymphal notogastral skins, which are carried excentrically. Legs thick and rough, nearly all joints provided with horizontal blades: these are light yellow and reticulated. Claws monodactyle. Size 630 μ long, 470 μ broad. As all known Neoliodes are tridactyle, this specimen is not improbably a nymph. The monodactyle claw, and the state of the genital plates, which hardly appear to be functional, points to this being the case. The fully-grown nymph closely resembles the adult form throughout this genus. One, living. Baghghora, 6000 ft.

Sub-family **Phthiracarinæ.**

Genus *Hoploderma.*

20. *H. claviger* sp. n.—Light brown, coarsely areolated: this is not easy to see. Carina on aspis, but not on abdomen. Pseudo-stigmatic organs rather exceptional for the genus; they are moderately long and thin, and are thickened distally (slightly clavate). A few fine hairs on notogaster. Claws monodactyle. Size, extended, 680 μ. Two, living. Baghghora, 6000 ft.

How can we account for so wide a distribution? Slow-moving, non-parasitic, living in mosses, fungi, rotten wood, etc., not usually very numerous in individuals, this family has none of the facilities for transport and dispersal possessed by other Acarina—Tyroglyphidæ, for instance, preying on man's food, multiplying with great rapidity, swarming often in vast numbers, may well be carried and dispersed almost everywhere. No doubt the great tenacity of life which Oribatidæ possess is an important factor. Many individuals reached me alive and in good condition—a ten thousand mile journey and a confinement of several weeks without air or light, and with little food or moisture, seeming to do them no harm. Human agency we may, I think, neglect. It can have had but little effect. The question remains extremely puzzling; our data are still very scanty, so it does not seem possible to answer it in the present state of our knowledge. Workers in this field are very few, unfortunately; how much might be accomplished if only naturalists, especially in tropical countries, would collect and send home Acarina for identification. Such assistance would be invaluable; will anyone undertake to help?

EXPLANATION OF PLATE XIII.

Fig. 1.—*Oribata fallax.*
„ 2.—*Liacarus nigrescens*, cephalothorax.
„ 3.—*Chaunoproctus cancellatus*: a texture of chitin.
„ 4.—*Chaunoproctus asperulus.*
„ 5.—*Notaspis hamatus*, cephalothorax.
„ 6.—*Amerus speciosus.*
„ 7.—*Neoliodes ocellatus* (? nymph).

VIII.—*New Finder for the Microscope.*

By Joseph M. Coon.

Being engaged on research work necessitating frequent reference to the microscopical slides prepared in connection therewith, and requiring to indicate parts to correspondents, the usual methods of "finding" were found to be less convenient than is desirable.

On any given Microscope provided with a divided stage or engraved Wright's Finder, it is easy to "re-find" parts wanted by a simple method of registration; but without calculations or the construction of a new register for each instrument in use, slides "registered" on one Microscope cannot be "found" on another, unless the instruments are exactly alike in their calibration—a most unlikely occurrence.

The Maltwood Finder enables different instruments to be used

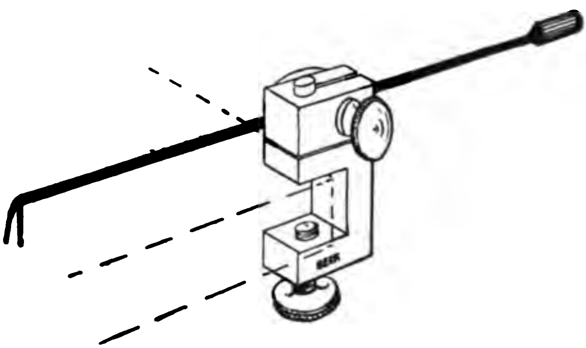


Fig. 40.

if provided with a mechanical stage or Wright's Finder, but it is difficult on instruments with sliding bar only, and much more so if the stage is only provided with spring clips. Each "find" also requires changing the slide for finder, and finder for slide, and thus focusing twice. It will also be recognised that slight differences in dimensions of glass on which Maltwood's Finder is printed, or in position of ruling, will introduce difficulties from lack of interchangeability.

The finder now described is extremely simple, can be used on any Microscope, whether provided with mechanical stage, sliding bar, or spring clips, and objects registered on one Microscope can be found on any other; and, further, any number of parts on a slide

can be referred to, or parts repeated without removing the slide from the stage, a matter of very great convenience when using immersion objectives—in fact, it is easier to find objects with it than by the mechanical stage, because the light available is often insufficient or inconveniently placed for reading stage divisions.

The actual design of finder may vary, but it essentially consists of a means of attaching to the Microscope a pointer with universal movement (fig 40). The finder exhibited this evening has a plain clamp with milled-head screw for fastening to stage; on clamp is mounted a pointer holder with horizontal motion, a screw through which holds the pointer; this pointer has a vertical and sliding motion, and is clamped by the screw when adjusted.

In conjunction with the finder a registering label is used. This may be ruled in many ways, but the author has found the ruling shown (fig. 41) very suitable and simple.

The vertical columns of large squares are indicated by *capital letters*, the horizontal lines of large squares by *numbers* on the left hand; each square is divided into four smaller squares, indicated by small letters, *a*, *b*, *c*, *d*, and each small square into four triangles by diagonal lines. The side of each small square equals 1·25 mm.; by the triangles it is quite easy to indicate the position of the pointer to $\frac{1}{5}$ of this, or say 0·25 mm., or $\frac{1}{100}$ of an inch. The field of a Zeiss 2 mm. N.A. 1·40 objective is given as 0·25 mm. diameter. It is quite evident, therefore, that high powers can be used with the finder. The author finds no difficulty in using a $\frac{1}{4}$ Beck; of course care must be used, and, with high powers, the quiet of a laboratory is most helpful. The label, besides its ruling, has two marks, one called the registering mark, and the other the focusing mark.*

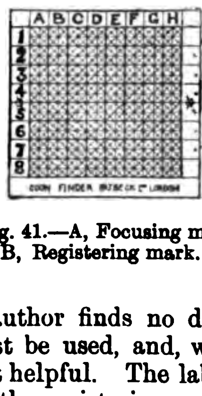
A  B

Fig. 41.—A, Focusing mark. B, Registering mark.

To register a slide, the objective is focused on the focusing mark, and the pointer adjusted to registering mark.

The slide is then searched and parts registered. (For immersion lenses the focusing mark is best placed on the vacant space of cover-glass.) To register: the capital letter over large square, number opposite, small square under by its small letter, and position in triangle by a dot, thus . A complete record might be—A 1 *a* , and would indicate that the part is in field when the pointer is under A, opposite 1, over *a*, and in centre of upper triangle.

* The author finds that it is really best, always to place the focusing mark on clear space of cover-glass, as it is easier found; a very fine dot or cross of Indian ink or gentian-violet in Holles glue is very durable and suitable.

To find an object already registered: focus on focusing mark, adjust pointer over registering mark, move slide so that pointer stands over part of label indicated by register—then the object should be in field of objective. The slide must be kept in contact with bar or stops on stage.

If the Microscope has only spring clips to stage, the pointer has two points, or other equivalent means of adjustment, parallel with the ruling in label. The right-hand point is set to registering mark, left-hand point on line continuing from it horizontally, the objective being focused as before; the only necessary variation in use being to remember to indicate with the right-hand point, and keep slide in such position that both points are equidistant from any horizontal line on label. The slide may be moved vertically or horizontally, but must finally be adjusted parallel to its first position, or the object will not be in field.

OBITUARY.

Lionel Smith Beale, F.R.S., etc., President R.M.S., 1879–80. Treasurer R.M.S., 1881–90.

Lionel Smith Beale was born in 1828, in a house close to the Church of St. Paul, Covent Garden. He received his early education at a private school at Highgate, and later at King's College, with which institution he was closely associated till his death. In 1847 he went to Oxford as anatomical assistant in the museum to Henry Acland. He held this appointment for two years, and then returned to London, where he took his M.B. degree in 1851. In 1852 he established a laboratory, where he taught normal and morbid histology and physiological chemistry. In 1853 he was appointed Professor of Physiology at King's College, and in 1869 Physician to King's College Hospital and Professor of Pathological Anatomy.

Professor Beale was made a Fellow of the Royal Society in 1857, at the early age of twenty-nine, and two years later he received the Fellowship of the Royal College of Physicians.

He joined the Society in 1852, was President in 1879–80, and Treasurer from 1881–90.

In 1896 he resigned his appointments at King's College and King's College Hospital, owing to a slight attack of cerebral hæmorrhage; he was then made Emeritus Professor of Medicine and Consulting Physician to the hospital. From this seizure he never properly recovered, and finally succumbed to another attack of hæmorrhage on March 28 of the present year.

In 1859 he married Frances, daughter of Rev. Peyton Blakeston, M.D., F.R.S., and leaves a son, Mr. Peyton T. B. Beale, Surgeon to King's College Hospital, a Fellow of the Society, and for many years Demonstrator of Histology, and Lecturer on Biology in King's College, London.

Beale's work is variously estimated, but, like that of some others, is less appreciated in this country than abroad. As a physician, there is no doubt that he was extremely able, though his methods were different from the ordinary. He examined patients with rapidity, apparently carelessly, and arrived at a correct conclusion in much less time than many take to elaborate an erroneous diagnosis. As Medical Adviser to the Clerical and Medical Assurance Company, he made many thousands of examinations, and his results were used as an actuarial basis for estimating the probabilities of life.

To the microscopical world he is best known by "How to Work with the Microscope," and "The Microscope in Medicine," both of which have run through numerous editions. He also wrote on "The Liver," "Kidney Diseases, Urinary Deposits, and Calculi," "Slight Ailments and their Treatment," "The Mystery of Life," "The Ultimate Nerve-Fibres distributed to the Muscles and to some other Tissues," "Life and Vital Action in Health and Disease," and other works on religion and science.

Though some of his views were generally unacceptable—e.g. on Vitality, Bioplasm, etc.—there can be no doubt to any one who has examined his reproductions of things observed by him under the Microscope, that he was a most faithful delineator, as well as an accurate and acute student, in many respects in advance of his time. And though it may not be possible to draw the same conclusions as he did, the facts remain, and they show conclusively that he was a great pioneer in microscopical cytology, histology, and physiology, and particularly in high-power work prior to the day of immersion objectives.

His method of preparation was, briefly, as follows. The tissues were stained either by immersion in "Beale's carmin fluid," or by injection of an alkaline carmin solution through the aorta. In the latter case this was in due course followed by a Prussian-blue solution, which remained precipitated in the blood-vessels. The tissues were then soaked in acid-glycerin, thus causing the carmin to be precipitated in a very fine form in every particle of "bioplasm," or living matter, the carmin in the non-living, or "formed" material, being washed out by soaking in dilute glycerin. The pieces of tissue for examination were then soaked for many months in glycerin of increasing strengths, and finely teased out preparations were eventually mounted in pure glycerin. Many of these preparations were investigated under a $\frac{1}{50}$ dry objective, and it is worth while noting that some of the actual specimens made fifty years ago are still extant and in excellent preservation. Much of his work was done on the *Hyla* and the maggot of the blow-fly, and the method adopted for staining is practically the same as that recently come into vogue and known as "supravital."

Communications made to The Royal Microscopical Society by the late Professor Lionel S. Beale.*

1. A Simple Form of Portable Microscope, with Lever Adjustment, which may be adapted to several different purposes. Trans. Micr. Soc. London, iv. (1856) pp. 13–14.
2. On a Portable Field or Clinical Microscope. (Read Dec. 10, 1860.) Op. cit., ix. (1861) pp. 3–4.

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* A portrait of the late Professor Beale is given in Journal R.M.S., 1886, facing p. 625.

3. On the Formation of the so-called Intercellular Substance of Cartilage, and of its relation to the so-called Cells, with Observations on the process of Ossification. (Read March 1, 1863.) Op. cit., xi. (1863) pp. 95–104.
4. Observation upon the Nature of the Red Blood-Corpuscle. (Read Dec. 9, 1863.) Op. cit., xii. (1864) pp. 32–43.
5. On the Germinal Matter of the Blood, with Remarks upon the Formation of Fibrin. (Read Dec. 9, 1863.) Tom. cit., pp. 47–63.
6. On the Structure and Formation of the Sarcolemma of Striped Muscle, and of the exact relation of the Nerves, Vessels, and Air-Tubes (in the case of Insects) to the Contractile Tissue of Muscle. (Read June 8, 1864.) Tom. cit., pp. 94-108.
7. Nutrition from a Microscopical Point of View. (Read May 8, 1867.) Op. cit., xv. (1867) pp. 75–85.
8. On the Germinal Matter of the Ovarian Ova of the Stickleback. Tom. cit., xv. (1867) pp. 85–6.
9. Protoplasm and Living Matter. (Read before the R.M.S., April 14, 1869.) Monthly Microscopical Journal, i. (1869) pp. 277–88.
10. The Nerves of Capillary Vessels and their probable Action in Health and Disease. (Read Dec. 6, 1871.) Op. cit., vii. (1872) pp. 4–9; concluded in viii. (1872) pp. 55–66.
11. On the Relation of Nerves to Pigment and other Cells or Elementary Parts. (Read Dec. 6, 1871.) Op. cit., vii. (1872) pp. 45–7.
12. Beale's Nerve Researches: Dr. Beale in Reply to Dr. Klein. (Read May 1, 1872.) Tom. cit., pp. 253–5.
13. The President's Address: Living Matter. (Read Feb. 11, 1880.) Journ. R.M.S., iii. (1880) pp. 202–24.
14. The President's Address: The Microscopic Limit and Beyond. (Read Feb. 9, 1881.) Op. cit., i. series 2 (1881) pp. 180–202.
15. The Constituents of Sewage in the Mud of the Thames. (Read Jan. 10, 1884.) Op. cit., iv. series 2 (1884) pp. 1–19.

JOHN JEWELL VEZEY, Treasurer R.M.S.
1844–1906.

JOHN JEWELL VEZEY was educated at a private school, and for some forty years was engaged in business as a wharfinger in Mincing Lane. He was extremely versatile, and educated himself in science, music, and theology. Unostentatiously but enthusiastically religious, he devoted much time to the service of the Church, while his practical benevolence was shown by the interest he took in the Millar Hospital, at Greenwich, where he had honorary charge of the electrical department, and spent two evenings a week in administering electrical treatment to the sick poor.

Mr. Vezey took great interest in the doings of scientific societies, and was a constant and assiduous attendant at the meetings of the Society of Arts, the Royal Institution, Royal Microscopical Society, Quekett Microscopical Club, Röntgen, and Royal Photographic Societies.

To Mr. Vezey the Royal Microscopical Society is much indebted not only for the interest he took in its proceedings, but for

the energy he displayed in helping to organise and make the Meetings of the Society more interesting. When elected Treasurer, on the demise of Mr. Suffolk in 1900, his business capacity was soon found to be of enormous value in dealing with the financial affairs of the Society.

His death, which occurred with great suddenness while engaged in his charitable work at the Millar Hospital, deprives the Society of a much respected Fellow, who as Member of Council and Treasurer, rendered invaluable service to the Society. His genial presence will be sorely missed, and the gap left by his death hard to fill.

SUMMARY OF CURRENT RESEARCHES

RELATING TO

ZOOLOGY AND BOTANY

(PRINCIPALLY INVERTEBRATA AND CRYPTOGAMIA),

MICROSCOPY, ETC.*

ZOOLOGY.

VERTEBRATA.

a. Embryology.†

Foundations of Embryology.‡—Bruno Bloch has made a scholarly contribution to the history of Embryology, in which he deals with the "foundations," if they are worthy of that title. His chapters discuss (1) the Hippocratic school, (2) Aristotle, (3) Galen, (4) from Galen to the beginning of the sixteenth century, and (5) thence to Harvey.

Interstitial Cells in Ovary of Rabbit.§—Janet E. Lane-Claypon has studied the origin and life-history of these elements. A large number of germinal cells become imbedded in the subjacent mesoblast. Of these the great majority undergo transformations up to a certain stage. This stage having been reached, they may pass through the necessary processes of ovogenesis, or they may become modified to form either follicle cells or interstitial cells, this last process being the chief fate of those near the periphery, whilst ovogenesis occurs in those more centrally situated.

The interstitial cells are thus potential ova, capable of becoming ova should the appropriate stimulus be given. This stimulus is provided by pregnancy, during which the interstitial cells undergo enlargement in size, exceeding that of a primordial ovum. About the twenty-third day some of the interstitial cells become cut off near the

* The Society are not intended to be denoted by the editorial "we," and they do not hold themselves responsible for the views of the authors of the papers noted, nor for any claim to novelty or otherwise made by them. The object of this part of the Journal is to present a summary of the papers *as actually published*, and to describe and illustrate Instruments, Apparatus, etc., which are either new or have not been previously described in this country.

† This section includes not only papers relating to Embryology properly so called, but also those dealing with Evolution, Development, Reproduction, and allied subjects.

‡ Nova Acta Leopold-Carol. Acad. Halle, lxxxii. (1904) received 1906, pp. 217–334.

§ Proc. Roy. Soc., Series B, lxxvii., No. B 514 (1905) pp. 32-57 (1 pl.).

periphery, and pass through the nuclear transformations of ovogenesis, becoming true ova.

Œstrous Cycle in Dog.*—F. H. A. Marshall and W. A. Jolly point out that the bitch is monœstrous, and has typically two sexual seasons in the year, while the wild species in their natural state have only one sexual season annually. The domestic cat has three or four sexual seasons in the course of the year: it is polyœstrous, and may have four heat-periods in a single sexual season; the wild cat probably experiences only one sexual season in the year. The lioness, failing pregnancy, may have several annual sexual seasons, at the same time being polyœstrous; bears, polecats, and seals, and probably most other carnivores, appear to be monœstrous and breed once a year, but the otter, in captivity at least, is polyœstrous. The histological changes which the uterus undergoes during the cycle may be divided into the following periods:—

1. Period of rest	. . . .	anœstrum.
2. „ growth and congestion	.	procœstrum.
3. „ destruction	. . .	
4. „ recuperation	. . .	œstrus. metœstrum.

Ovulation in the bitch takes place after external bleeding has been going on for several days. It occurs during the period of œstrus, but is quite independent of insemination. The hypothesis that the entire procœstrous process is of the nature of a preparation for the lodgment of the ovum is in accordance with the facts.

The authors note that no systematic investigation as to the vitality of spermatozoa in mammals has been hitherto attempted, but they have ascertained that the period of survival in the male passages of rabbits is probably not more than ten days.

Ovary as an Organ of Internal Secretion.†—F. H. A. Marshall and W. A. Jolly conclude that the ovary is an organ providing an internal secretion, which is elaborated by the follicular epithelial cells or by the interstitial cells of the stroma. This secretion circulating in the blood induces menstruation and heat. After ovulation, which takes place during œstrus, the corpus luteum is formed, and this organ provides a further secretion whose function is essential for the changes taking place during the attachment and development of the embryo in the first stages of pregnancy.

Maturation-Divisions.‡—Victor Grégoire has set himself the laborious task of summarising the main results which have been reached in regard to maturation-divisions in plants and in animals. Having done so, he attempts a synthesis, or, where that is not possible, a balance-sheet of the results. His general conclusion is, that in a large number of cases the processes conform to one scheme, which he calls "heterohomeotypic." The gist of this scheme is as follows:—

1. The two constitutive branches of the definitive chromosomes (I) separate from one another in each chromosome at the first kinesis.

* Proc. Roy. Soc., Series B, lxxvi., No. B 511 (1905) pp. 395–8.
† Loc. cit. ‡ La Cellule, xxii. (1905) pp. 221–376.

2. The daughter-chromosomes (I) undergo, towards the end of the metaphase, or during the anaphase, a longitudinal division.

3. The daughter-chromosomes (I), thus constituted, preserve their autonomy during the interkinesis. They become the chromosomes (II), and the longitudinal anaphasic halves become the constitutive branches of chromosomes (II).

4. These branches, and consequently the longitudinal anaphasic halves, separate in each chromosome in the second figure.

Spermatogenesis in Batrachoseps attenuatus.*—F. A. Janssens communicates a third study on the spermatogenesis of this Batrachian. He deals especially with the history of the auxocytes. It is extremely probable that the 12 chromosome-branches (*anses de bouquet*) result from the fusion in pairs of the 24 chromosomes of the last somatic kinesis, and that the double chromosomes of the prophases of the heterotypic division result from the longitudinal cleavage of the *anses de bouquet*.

Testicular Secretion.†—P. Bouin and P. Ancel relate some experiments on guinea-pigs which go to show that the results of castration (on the development of the skeleton and accessory genital organs) may be attenuated by sub-cutaneous injections of extract of the interstitial gland of the testis. The material for injection was obtained from several large mammals.

Alleged Ovulase of Spermatozoa.‡—Antoine Pizon discusses Piéri's theory of a soluble ferment (ovulase) contained in spermatozoa and provocative of segmentation. His experiments do not in the least confirm Piéri's view : there is no evidence of any such ferment.

Toxic Properties of Seminal Fluid.§—G. Loisel has studied experimentally the toxic properties of seminal fluid from many animals. There is, he thinks, no doubt that the testes secrete or excrete toxic substances especially affecting the nervous system. It may be that some toxalbumin carried by the spermatozoa acts as an excitant to the protoplasm of the egg.

Placentation in Ungulates.‖—R. Assheton points out that the formation of the placenta in *Ungulata vera* is founded on a system of foldings of the subzonal membrane (or of the trophoblast only), which fit into corresponding grooves in the walls of the uterus, without thickening of the trophoblast layer of the blastocyst, and without destruction of maternal epithelium or other tissue (*Sus*). Certain parts of the crests of the ridges are produced by local amplification into true villi, into which the splanchnopleure of the allantois subsequently extends (*Equus*, *Bos*, etc.). This plicate placenta (Ungulates, and perhaps Cetacea, Sirenia, Proboscidea) is contrasted with the cumulate type (in Rodents, Insectivora, Hyracoidea, Primates, Chiroptera), in which the placenta is formed by the heaping-up or thickening of the

* La Cellule, xxii. (1905) pp. 379–425 (7 pls.).
† Comptes Rendus, cxlii. (1906) pp. 232–4.
‡ Op. cit., cxli. (1905) pp. 908–10. § Tom. cit., pp. 910–12.
‖ Proc. Roy. Soc., lxxvi. No. B 511 (1905) pp. 393–4.

trophoblast layer, among the cells of which accumulation extravasated maternal blood circulates. The Carnivora are perhaps intermediate, and the sheep's placenta is at that end of the series of plicate forms which closely approaches the cumulate type. The elephant's placenta at half term and at full term closely approaches that of the sheep, but that of *Hyrax* is typically cumulate.

Ferments of the Placenta.*—Charrin and Goupil adduce some facts which suggest that the placenta has a glandular function. It can retain and modify various substances, or continue processes elsewhere begun. There is evidence of a glycolytic substance (forming alcohol from glucose) and also of a proteolytic fermentation.

Amnion-Invagination in the Formation of Chick's Lens.†—Aurel von Szilly notes that in many cases during the formation of the lens-vesicle there is an invagination of a small portion of the amnion. The same was also noticed in connection with the development of the auditory vesicle.

Pre-Oral Gut in Bird Embryos.‡—Giunio Salvi has made a detailed study in many birds of that part of the anterior gut which precedes the formation of the stomodæum, and is known as the pre-oral gut.

Double Embryo of Florida Alligator.§—Albert M. Reese describes what is probably a unique case, the occurrence of two embryos in the egg of the alligator. The egg was of the usual size; the yolk was single and of the usual size; the two embryos were entirely distinct, but lay so close together that their vascular areas were flattened against each other. About 15 pairs of mesoblastic somites were visible, and the neural canal was practically inclosed.

Double Embryo of a Lizard.‖—J. J. Tur describes a double-embryo in a Javanese lizard (*Mabuia multifasciata*), which apparently arose from a common blastoderm with two gastrula-invaginations, probably far separate though included in one area pellucida.

Giant Tadpoles.¶—Emil Yung describes some giant tadpoles of *Rana esculenta*, collected in August from a quiet shallow part of the Aire, near Geneva. Not only were they unusually large, but the intestine was unusually long in proportion to the body. While tadpoles hatched artificially had an intestine 122 mm. in length (8·62 times the length of the body), the giant tadpoles had an intestine 235·8 mm. in length (12·71 times the length of the body). Similar figures are given for different stages. The author thinks that the length of the intestine is mainly related to the volume and weight of the nutritive contents of the gut. The giant tadpoles had the intestine absolutely filled with the rich mud of their habitat.

* Comptes Rendus, cxlii. (1906) pp. 595–7.

† Anat. Anzeig., xxviii. (1906) pp. 231–4 (4 figs.).

‡ Atti Soc. Toscana Sci. Nat. Pisa, xxi. (1905) pp. 83–158 (1 pl., 22 figs.).

§ Anat. Anzeig., xxviii. (1906) pp. 229–31 (1 fig.).

‖ Arbeit. Zootom. Lab. Warschau Univ., xxxiii. (1904) pp. 1–35 (1 pl. and 33 figs.) (Russian.) See also Zool. Zentralbl., xiii. (1906) pp. 117–18.

¶ Arch. Sci. Phys. Nat., xx. (1905) pp. 595–7.

Development of Pancreas in Discoglossus pictus.*—Empedocle Goggio gives a full account of the early development of the pancreas in this anurous Amphibian. It takes its origin from three primordia, one dorsal to the intestine, the others disposed laterally at the region of the liver. The history of these primordia, e.g. the fusion of the dorsal with the right ventral, is traced.

Viviparous Frog.†—G. Tornier describes *Pseudophryne vivipara* sp. n., from German East Africa, which is interesting in being the only known viviparous frog, and also inasmuch as the other species of the genus are recorded from Australia. In the enlarged lower ends of the oviducts there were 30–37 almost fully formed young frogs, with head and mouth of the definitive form, with conical legs of considerable size, with the anus between and above the hind legs, with a large mass of still unused yolk in the body cavity, with a long cylindrical tail not adapted as a locomotor organ.

Influence of Light on Pigmentation of Amphibian Ova and Larvæ.‡—Oskar Schultze has made numerous experiments bearing on this interesting question. In the case of *Rana esculenta*, *Triton tæniatus*, and *Salamandra maculata*, subjected to different sets of rays, he found no demonstrable influence on the development or condition of the larvæ. Eggs of *Rana fusca*, *R. esculenta*, and *Bufo cinereus* reared in complete darkness showed no deviation from the normal, either as regards length of development or degree of pigmentation, but larval salamanders kept in the light showed a progressive decrease in the darkness of the pigmentation. Schultze admits that in certain cases the illumination has undoubtedly an influence on pigment formation, but in general it must be said that the formation of pigment is so intimately bound up with the hereditary constitution that there is no dependence on the degree of illumination.

Urogenital System of Elasmobranchs.§—I. Borcea has made a detailed embryological and anatomical study of the urogenital system in representative types of Elasmobranchs, and shows that there is no hiatus between Anamnia and Amniota in the evolution of this system in the vertebrate series. We cannot do more than refer to a few points to which the author directs special attention: the distinction between segmental canal and renal canaliculus; the significance of islands of lymphoid tissue found in some types alternating with the segments of the kidney; the participation of the primary ureter in the formation of the terminal part of the segmental canals and of the renal canaliculi, and in the formation of the definitive ureter; the differences in the two sexes and the modifications associated with sexual maturity; the necessity of distinguishing (*a*) the glandular portion composed of secretory canals (segmental canals or renal canaliculi derived therefrom), and (*b*) an efferent portion formed by the primary ureter and its derivatives; these two portions have a distinct origin though they both

* Atti Soc. Toscana Sci. Nat. Pisa, xxi. (1905) pp. 33–48 (1 pl.).
† SB. k. Preuss. Akad. Wiss. Berlin, xxxix. (1905) pp. 855–7.
‡ Op. cit., xlii.–xliv. (1905) pp. 917–28 (2 figs.).
§ Arch. Zool. Expér., iv. (1906) pp. 199–484 (2 pls., 103 figs.).

arise as evaginations from the same part of the mesoderm. Three types of kidney development are represented by *Acanthias*, *Scyllium*, and *Raia*.

Inheritance of Coat-Colour in Rats.*—L. Doncaster gives the results of experiments which dealt chiefly with the power of albinos to transmit colour or pattern when mated with coloured individuals, and with the nature and relations of certain of Crampe's types of colour. Albino rats are not all similar in constitution; some carry the determinant for brown, others black, and others, again, both brown and black. So also with pattern; some carry the piebald character, some the "self" (or "Irish"). There seems to be no doubt that the brown forms (Crampe's types 1, 2, 3) correspond exactly with the similar black forms 7, 6, and 5, but are less simple to work with, since they may contain recessive black. A point of some interest is the great diversity of different litters from the same pair. Where enough offspring are reared the results are in fair accord with Mendelian expectation, but in individual litters this is often far from being true. Large numbers of young, therefore, must be reared from each pair before the true proportions are known with any accuracy.

b. Histology.

Intercellular Bridges and Leucocyte-Paths.†—Fr. Reinke discusses the connection between intercellular bridges (and gaps) in epithelium and the paths of migratory leucocytes. It may be that in cases like the epithelium of an amphibian gill-plate, the epithelial cells were directly in contact and formed a syncytium, and that the cells were first separated by the immigration of leucocytes. Bridges and gaps were thus formed as secondary results—as "paths of wandering cells." Increased lymph pressure, associated with vigorous growth, would help. Indeed, three factors must be recognised: (1) the wandering cells, (2) the pressure of the lymph stream, and (3) the contraction of the protoplasm. The role of tropisms must be recognised: "epitheliophily" between epithelial cells brings about a syncytium; epitheliophily on the part of leucocytes brings about immigration; "leucocytophoby" on the part of the epithelial cells induces "cytochorism"; and, finally, there is a "karyophoby" between the leucocytes and the epithelial nuclei.

Human Epiderm Cells.‡—H. Schridde describes a remarkably regular arrangement of the protoplasmic fibres connecting the different cell layers of the human epidermis. These fibres, diagrammatically represented, are in the form of an ellipse in the lower layers, and more nearly circular towards the surface. At the points of crossing in the deeper layers there is no thickening, but in the more closely situated surface layers there is. Here, also, in the middle of the section of the protoplasmic fibres in the intercellular spaces, occur knob-like enlargements, the "Ranvierschen Knötchen." Incidentally, it is noted that the cerato-hyalin of the stratum granulosum frequently occurs in a clearly

* Proc. Cambridge Phil. Soc., xiii. (1906) pp. 215–28.
† Anat. Anzeig., xxviii. (1906) pp. 369–78 (3 figs.).
‡ Arch. Micr. Anat., lxvii. (1905) pp. 291–301 (1 pl., 3 figs.).

rhombic crystalline-like form; whether actual crystals are present is not certain.

Infundibulum in Fishes.*—Fr. A. Gemelli has made an histological study of the infundibular region in lamprey, sturgeon, salmon, and carp. His most important point is that the nervous lobe of the hypophysis is in these forms most definitely separated off from the glandular lobe, and shows in its minute structure a remarkable approximation to sensory structures such as epiphysis and olfactory mucous membrane. The possibility of its being in part a sensory organ is suggested.

Rod-like Gland Cells in Fishes are Sporozoa.†—E. Laguesse maintains that the "Stäbchendrüsenzellen" described in various organs of fishes by Marianne Plehn are really Sporozoa. Thélohan and Laguesse described the occurrence of these parasites in many fishes in 1892, and Laguesse named one of them (in 1895) *Rhabdosphora thélohani*.

Endocellular Nets in Ganglion Cells.‡—G. A. Jäderholm asserts that the statements of Donaggio, Cajal, etc., that the neurofibrils form nets in the ganglion cells (especially motor cells), is untenable. He has investigated the subject, and finds that different results are obtained by different methods of fixation. The method which gives figures nearest to the actual condition of the cells is that of Bethe.

Nerves of Auditory Organ in Petromyzon fluviatilis.§—R. Krause describes the relations of the nerve-endings in the neuro-epithelium, the minute structure of the hair-cells of the crista and macula, and discusses the homology of these hair-cells and ciliate cells, between which he recognises many agreements.

Study of Cartilage.‖—Josef Schaffer continues his study of the different forms of cartilage. He describes in detail the cartilaginous tissue in *Myxine glutinosa*, and the cartilage-like vesicular supporting tissue in the same animal. Reference is also made to the hard cartilage-tissue in lampreys, and there are some notes on the morphology of the skull in the hag.

Secretion in Liver Cells.¶—E. Wace Carlier discusses the process of secretion of ferments by the liver cells of the white rat, and describes some of the changes observable in the cells during digestion. The liver cells are called upon twice during the period of digestion to produce ferments; the first secretion of zymogen (15 minutes after the commencement of a meal) is purely psychic in origin and perhaps reflex; the second secretion commences in about an hour after complete recovery from the effects of psychic stimulation (between the fifth and sixth hour after feeding); the amount of the second secretion, and the time required to recover from it, depend entirely on the nature of the food; the liver cells work as producers of ferment in relays; vacuo-

* Journ. de l'Anat. Physiol., xlii. (1906) pp. 77–86 (1 pl.).
† Anat. Anzeig., xxviii. (1906) pp. 414–16.
‡ Arch. Mikr. Anat., lxvii. (1905) pp. 103–23 (2 pls.).
§ SB. k. Preuss. Akad. Wiss. Berlin, xlviii. (1905) pp. 1015–32.
‖ Zeitschr. wiss. Zool., lxxx. (1905) pp. 155–258 (3 pls.).
¶ La Cellule, xxii. (1905) pp. 431–56 (2 pls.).

lation, often excessive, occurs in the liver cells immediately after recovery from psychic secretion: it is chiefly due to the presence of glycogen in the cells; the precipitate produced in the cytoplasm by fixing reagents varies somewhat with the nature of the food; changes described as due to poisons are in some cases merely normal changes due to functional activity.

c. **General.**

Photogenic Marine Animals.*—W. C. M'Intosh notes that since he gave his British Association Address, sixteen years ago, on the phosphorescence of marine animals, noteworthy progress has been made only in two departments—(1) as regards the role of photogenic bacteria, and (2) in the extension of our knowledge of luminous fishes.

As a general rule, phosphorescence in marine animals shows itself under four conditions, three of which are connected with structure:—

1. The animals present special cells which, under certain circumstances, secrete a phosphorescent mucus.

2. The special cells produce light without mucus or other visible secretion.

3. The animals emit light under the action of the nervous system without special differentiation of the tissues.

4. The phosphorescence is due to photogenic bacteria.

The author in his luminous lecture gives a wealth of examples of these various kinds of "phosphorescence."

Pelagic Animals.†—C. Apstein has written a little book for travellers giving an account of the open-sea animals and their distribution, dealing also with the colour of the sea, phosphorescence, and the like.

Genesis of Protoplasmic Motion and Excitation.‡—T. Brailsford Robertson sketches a theory. Loeb and others have shown that proteids take up ions to form a loose compound (ion-proteid), These ion-proteid molecules must always be breaking down, and there must be a number of free ions in any protoplasmic body, and therefore a difference of potential between it and its medium.

If changes in surface tension take place, movements must follow, but since the number of free ions in a protoplasmic body must always be changing, or subject to change, the surface tension must also change.

This mode of accounting for movements is used to interpret galvanotaxis, chemotaxis, muscle-contraction, plant movements, etc. "It is probably capable of explaining the whole of the vast complex of facts which have been gathered together under the head of phenomena of contractility and irritability."

Activity of the Isolated Heart.§—M. Lambert finds that by using Ringer's fluid the excised heart of the frog may be readily kept spontaneously beating for five days. The chief cause of arrest in such cases

* Zoologist, x. (1906) pp. 1–20.
† Das Tierleben der Hochsee. Kiel (1905) 115 pp., 174 figs. See also Zool. Zentralbl.. xiii. (1906) pp. 160–1.
‡ Trans. Roy. Soc. S. Australia, xxix. (1905) pp. 1–56.
§ Comptes Rendus, cxlii. (1906) pp. 597–9.

is the exhausting of reserves, and it seems likely that the beating could be sustained longer with a still more suitable—aseptic and nutritive—fluid.

Physiology of the Pancreas.*—H. G. Chapman has made a number of experiments leading to the following conclusions. Secretins from the Echidna, Wallaby, Australian water-tortoise, and Ibis, are active upon the dog in causing a flow of pancreatic juice. Secretin does not appear to cause pancreatic secretion in the Echidna. The flow of pancreatic juice produced by pilocarpine is inhibited by atropine, while the flow produced by secretin is not so inhibited. Stimulation of the vagus nerve does not inhibit the secretion due to secretin. The pressure under which the fluid is secreted in the pancreatic duct is equivalent to 9 inches of the juice. Pancreatic juice may be activated by leucocytes so that it acts upon proteids.

Nature of the Thymus.†—Ph. Stöhr maintains that the thymus is from beginning to end an epithelial organ, just like a salivary gland. It is no cradle of leucocytes, as some have tried to show.

Rare Abnormality in Man.‡—Gaetano Cutore describes in a man of fifty-eight the rare abnormality known as "Perobrachius achirus." The left arm was greatly reduced, and showed a complete absence of the bones of the carpus, metacarpus, and phalanges.

Vestige of Notochord in Skull of Centetes.§ — W. Leche calls attention to a strand-like structure which occurs in the adult skull of *Centetes ecaudatus* in the median line in a ventral groove in the anterior portion of the basisphenoid and posterior portion of the presphenoid in front of the pituitary fossa. The vesicular supporting tissue and the facts of development appear to Leche to make it clear that in *Centetes* (and also in *Ericulus*) there is even in the adult skull a persistent vestige of the notochord.

New Species of Orycteropus.‖ — Einar Lönnberg describes *Orycteropus erikssoni* from Northern Congo, and has been able to throw new light on the peculiar teeth. It seems that the crowns are rudimentary, and are in a short time completely worn off. The functional teeth are thus the homologues of the roots of former teeth and of the roots of normal mammalian teeth. Thus "the seemingly insurmountable barriers derived from the dentary system of the Tubulidentata, which appeared to exclude them from all other Mammalia, are broken down to a reasonable height." It does not seem impossible that the ancestors of the Tubulidentata are to be found among the Condylarthra or some related types of early mammals.

Aquatic Genus of Muridæ.¶—Oldfield Thomas describes *Anotomys leander* g. et sp. n., from Ecuador, which is evidently closely allied to

* Proc. Linn. Soc. N.S. Wales, xxx. (1905) pp. 92-100.
† SB. Phys. Med. Ges. Würzburg, 1905, No. 4, pp. 51-60.
‡ Anat. Anzeig., xxviii. (1906) pp. 222-9 (2 figs.).
§ Tom. cit., pp. 235-7 (1 fig.).
‖ Arkiv f. Zool., iii. (1906) No. 3, pp. 1-35 (1 pl. and 12 figs.).
¶ Ann. Nat. Hist., xcvii. (1906) pp. 86-8.

Ichthyomys. It is less specialised for an aquatic, piscivorous life in shape of brain-case and structure of incisors, but more so in the loss of ear-conch, character of fur, and peculiar build of muzzle. This entire suppression of the external ear-conches is an almost unique character in Muridæ, the only forms in which it is found being the mole-rats *Ellobius* and *Myospalax* (*Siphneus*).

Wild Cat in Ireland.* — R. F. Scharff has collected satisfactory evidence from various sources as to the former existence of wild cats in Ireland. In particular, he has examined a large collection of cat remains from certain caves near Ennis, in County Clare. There can be no doubt, he says, that a wild cat did exist in comparatively recent times in Ireland, which, however, was not identical with the European *Felis catus*, but with the African *Felis ocreata* Gmel., which had not a bushy tail. From this species, it would appear, the majority of domestic cats in Ireland have been derived.

Original Type of Canidæ.†—Albertina Carlsson investigates the problem as to whether *Otocyon caffer* is the original form of the canine race or not. A negative answer is given, and in support of it no less than thirty-two structural facts are adduced to show that it is less primitive than other living Canidæ. Of features which might be brought forward for the opposite view, seven tooth characters are enumerated.

Interlocking of Primary Feathers in Flight.‡—C. C. Trowbridge shows that when hawks are killed in coasting flight, a large percentage of the emarginate primaries are found firmly interlocked. The webs show well-defined "notches" where the edges of the interlocked webs have rested against one another. The interlocking of the primaries makes the end of the wing more rigid when the wing is employed as an aeroplane in coasting flight, produces a curvature of the wing which gives the bird better control in the air, and keeps the primaries partly extended without muscular exertion on the part of the bird.

Relation of Wind to Bird Migration.§—F. Smith describes an unusual flight of sparrow-hawks in Michigan, which appears to have been initiated and whose direction was probably determined by a north-east wind.

Antarctic Birds.‖—W. Eagle Clarke reports on the birds of the South Orkney Islands, etc., collected by W. S. Bruce on the 'Scotia' Antarctic Expedition. The series of bird-skins is one of the most important ever made in the Antarctic Seas, and, with 143 specimens, represents 16 out of the 18 species now known to frequent the South Orkneys and their vicinity. Some interesting descriptions are given of the penguin rookeries, and of the behaviour of the birds in courtship and in caring for the young. The ringed penguin, hitherto regarded as being nowhere an abundant species, was found to have its metropolis

* Proc. Roy. Irish Acad., xxvi. (1906) pp. 1–12 (1 pl.).
† Zool. Jahrb. Abt. Syst., xxii. (1905) pp. 717–54 (16 figs.).
‡ Amer. Journ. Sci., xxi. (1906) pp. 145–69 (19 figs.).
§ Bull. Michigan Ornithol. Club, v. (1904) pp. 77–8 (1 fig.).
‖ Ibis, vi. (1906) pp. 145–87 (11 pls.).

at the South Orkneys, where the summer population on Laurie Island alone was estimated at not less than one million birds. Among the important results we may note the finding of the eggs of the familiar Cape petrel (hitherto unknown to science) and of the chicks and young of the ringed penguin (*Pygoscelis antarctica*) and the snowy petrel (*Pagodroma nivea*), the remarkable extension of the known range of the Macaroni penguin (*Catarrhactes chrysolophus*), and of *Fregetta melanogaster*, which was undoubtedly breeding. There are some beautiful plates by H. Goodchild.

Skeleton of Tail in Birds.* — E. D. van Oort has made a study of the osteology of the tail in representatives of the main orders of birds, and has studied the development in the partridge, the black-headed gull, the moor-hen, and other forms. He discusses the taxonomic value of his results.

Semicircular Canals in Birds.†—J. Laudenbach has investigated the semicircular canals in a representative series of birds. They are least developed in swimming birds, best developed in the swallow. Experimental as well as anatomical results lead the author to conclude that the degree of development of the semicircular canals is correlated with the precision and nicety of equilibration in flight.

Habits of Necturus.‡—Albert C. Eycleshymer has studied *Necturus maculosus* Rafinesque. The adults vary from 12–18 in. in length; the coloration is very variable, and probably can be changed by the individual animal; the environment to which the animal is best adapted is not known; a casting of the epidermis was observed in winter; the time of egg-laying varies greatly with the temperature; the eggs were first deposited in those localities where the water is shallow, and exposed for the greater part of the day to the sun; the period of egg-laying usually covers two or three weeks; during egg-laying the males are never found with the females, and where they remain is unknown; the period of egg-laying covers many hours, and probably, in some cases, days.

Structure of Eye of Frog.§—D. Tretjakoff gives with considerable detail an account of the structure of the anterior region of the frog's eye. In the triangular chamber are two protractor lens-muscles and two tensors of the choroid. The protractors affect materially the form of the chamber, of the ciliary body, and the vascular distribution of the episcleral net. These vessels are arranged so that the main mass of arterial blood streams to the dorsal section of the annulus pericornealis; the main mass of venous blood flows in the ventral section. The iris of the frog is distinguished by the presence of the "pupilar knot," a derivative of the cavity of the eye vesicle; in the adult this contains a thickened modified stroma: in the embryo it is a purely epithelial formation.

* Tijdschrift Nederland Dierk. Ver., ix. (1905) pp. 1–144 (5 pls.).
† Ber. Kiew Nat. Ges., xvii. See also Physiol. Russe, iv. (1905) p. 64.
‡ Amer. Nat., xl. (1906) pp. 123–36.
§ Zeitschr. wiss. Zool., lxxx. (1906) pp. 327–410 (8 pls. and 19 figs.).

Unity of Gnathostome Type.*—Howard Ayers assumes a hypothetical group (Haeckel's Prospondylia) as the stock from which the Leptocardia and the Archicrania both arose. From the latter are developed all the Craniate forms, which are usually classified in two main divisions, the Cyclostomata and the Gnathostomata. But in 1894 the author showed that the so-called tongue apparatus of the Cyclostomes, particularly the Myxinoids, was developed by a transformation of the maxillo-mandibular apparatus of some Gnathostome ancestor. Other reasons strengthen his conviction that *all* the Craniata are Gnathostomes, and that the only living Acraniate is *Amphioxus*.

Ichthyological Notes.†—T. Wemyss Fulton describes two young conger-eels in the Leptocephalus-stage from the Moray Firth—rarities in British seas; a larval *Fierasfer* from the North Sea—another rarity; a sting-ray (*Trygon pastinacea*) from the Dornoch Firth—a very rare fish in Scottish waters; and a pilchard from the Moray Firth which is equally rare. He notes that the sprat shed at least 5000 eggs, but it is one of the least fecund of fishes, and, so far as is known, the least fecund of all fishes whose eggs are pelagic. He reports an albino plaice in which pigment was almost entirely absent; it lived for about a year, and differed from its neighbours in clinging to the side of the hatching-box close to the surface of the water. A reversed action of the gill-cover in plaice is also recorded.

Vendaces of British Lakes.‡—C. T. Regan describes *Coregonus vandesius* from Lochmaben, and *C. gracilior* sp. n. from Derwentwater and Bassenthwaite lakes, Cumberland. The former, which by some authors is united with *C. albula* of Northern Europe, can be separated from its nearest continental allies by several distinctive features. *C. gracilior*, though closely allied to the Lochmaben form, is by no means identical with it.

South American Cichlidæ.§—C. T. Regan completes his account of the American Cichlidæ in the British Museum. The paper consists of a revision of the genera *Cichla*, *Chætobranchus*, and *Chætobranchopsis*, and includes a synopsis of all the genera of the family, together with a discussion of their distribution and probable relationships.

Dentition of Characinoid Genus Piabuca.‖—W. S. Rowntree calls attention to certain interesting features in the dentition of this genus. The teeth are of singular beauty, being arranged in uniform series, and having spatulate crescentic crowns edged with minute gold-tipped serrations. Two points of some significance which have not been appreciated by other observers, are the existence of additional teeth not in series with the others, and the presence of teeth in the maxilla as well as in the premaxilla. In respect of this latter condition, *Piabuca* occupies a somewhat central position in the Characinidæ, in which family all intermediate stages are now shown to exist between the presumably primitive

* Amer. Nat., xl., (1906) pp. 75–94.
† Fishery Board for Scotland, Report 22, part iii. (1904) pp. 281–7 (1 pl.).
‡ Ann. Nat. Hist., xcviii. (1906) pp. 180–2 (1 pl.).
§ Tom. cit., pp. 230–9.
‖ Tom. cit., pp. 240–3 (1 fig.).

condition in which the maxilla bears teeth throughout its length, and that where the maxilla is toothless, and so reduced as to be practically excluded from the gape.

Notes on Loricariid Fishes.*—C. T. Regan finds that *Plecostomus horridus* Kner., is probably *P. tenuicaudata* Steind.; it is certainly distinct from *P. emarginatus* C. and V. A fresh description of the species is given. *P. Garmani* Regan, is not equivalent to *P. lima atropinnis* Eigenm., but to *P. lima* Eigenm. *Thysanocara* is proposed as a new sub-generic name for *Xenocara cirrhosum* and its allies. *X. brevipinnis* Regan is re-described. Other notes and descriptions are also given.

Flying-Fish Flight.†—C. D. Durnford discusses this subject. He is of opinion that flying-fish would require to have a wing-area several (and probably many) times greater, according to their weights, than they actually possess, to enable them to accomplish sailing flight in even such a restricted form as that carried out by sailing birds. We know of no parallel case in Nature which would justify the assumption that the possession by these fishes of even such increased fin-area would, of necessity, enable them to sail long distances (*a*) horizontally, or (*b*) close to an obstruction (the sea), or (*c*) in defiance of the direction of the wind; much less all three combined, as they commonly fly. Their common flight is exactly what is to be expected of fliers holding, as they do, a very low wing to weight ratio—fliers capable of, and of necessity employing, extreme wing-speed.

Dipnoan Affinities of Arthrodires.‡—C. R. Eastman finds that *Neoceratodus* bears intimate resemblances to Arthrodires on the one hand, and to Ctenodipterines on the other, but represents a more primitive structural type than either. Community of origin is necessarily presupposed for Sirenoids, Ctenodipterines, and Arthrodires. Arthrodires and Ctenodipterines may be regarded as specialised offshoots in different directions from primitive Dipnoan ancestors; and the more generalised descendants of the latter have alone survived until the present day. The primitive stock must have been autostylic, diphycercal, without a secondary upper jaw, and dentigerous, dentary elements; and with *Uronemus*- or *Dipterus*-like type of dentition—characters which do not permit us to ascribe the ultimate origin of Dipnoans to the Crossopterygii, but suggest rather a descent from *Pleuracanthus*-like sharks. The recognition of Arthrodires as an order of Dipneusti precludes their association with Ostracophores in any sense whatever, and the unnatural assemblage of "Placodermata" must be given up.

Respiration and Circulation in Monopterus javanicus.§—W. Volz finds a number of peculiarities in this Malayan Symbranchid, which "sleeps" in the dry season. The heart is unusually far from the head, and the aorta is formed (as in *Amphinous cuchia*) from the fourth pair of branchial arteries. The three anterior pairs take the blood especially to the superior wall of the pharynx; the gills are much reduced and

* Ann. Nat. Hist., xcvii. (1906) pp. 94–8. † Tom. cit., pp. 158–67.
‡ Amer. Journ. Sci., xxi. (1906) pp. 131–43 (4 figs.).
§ Arch. Sci. Phys. Nat., xx. (1905) pp. 580–1.

without lamellæ. Behind the junction of the two roots of the aorta, a strong cœliac artery arises, which takes the blood to the posterior end of the intestine; it divides into lateral branches, which sub-divide, and end in the intestinal epithelium, which is feebly developed. There is rectal respiration, and air may also enter by the mouth. The arterial blood passes by the portal vein to the liver, and the jugular veins also bring back arterial blood from the pharyngeal wall and reduced gills.

Respiratory Processes in Fishes.*—G. van Rynberk has studied the mechanism of respiration in dog-fish (*Scyllium*). In the first act there is a simultaneous opening of mouth and spiracles, by which the water enters, while the gill-clefts are closed. In the second act the mouth and spiracles are closed, while the water passes out by the gill-clefts.

In the reflex expulsion, water may pass out from the buccal cavity (α) by the mouth, if provoked by injurious stimuli; (β) by the spiracles, if provoked by mechanical or other stimuli; or (γ) by the gill-clefts, if provoked by mechanical stimuli of the gills, mucous membrane of the clefts, or surrounding skin.

There is a regular respiratory rhythm, which is peripherally determined, but is not exclusively due to contact with the water.

Eyes of Periophthalmus and Boleophthalmus.†—W. Volz finds that these fishes, which creep about on the tropical shore at low tide, have, unlike other fishes, a well-developed power of vision when out of water. The "campanule of Heller," serving for accommodation, is absent, and so is the falciform process. They are replaced by a delicate, transversely striated muscle, lying outside of the scleral cartilage. It extends towards the iris over the anterior part of the eye. When it contracts, the lens is brought nearer the eye, and accommodation for distant vision is thus effected.

Comephorus.‡—A. Korotneff gives a detailed account of the structure of this interesting fish from Lake Baikal. In addition to *C. baikalensis*, he describes a new species of *C. dybowski*; he found the male of the latter, but that of the former species is still unknown.

The pregnant females subsist on the abundant fatty mass surrounding the viscera. The gut is gradually atrophied, and becomes a thin tube not more than 1 mm. in diameter. Both species die after reproduction.

Carps and their Relatives.§—Theodore Gill discusses the family Cyprinidæ, the "leather-mouthed fish" of Izaak Walton, of which over a thousand representative species are known from Asia (especially India), Africa, North America, and Europe. None are found in South America, where their place is entirely taken by the Characinidæ, and there are none in Australia. The author summarises their characteristics, and has interesting notes on their habits, life-history, sexual differentiation, and familiar representatives, such as chub, dace, roach, rudd, minnow, and

* Atti Rend. R. Accad. Lincei Roma, xiv. (1905) pp. 708–18 (7 figs.).
† Arch. Sci. Phys. Nat, xx. (1905) pp. 579–80.
‡ Wiss. Ergebn. Zool. Exped. Baikal-See, part 2 (Kiew, 1905) pp. 1–39 (3 pls.).
§ Smithsonian Misc. Collections, xlviii. (1905) pp. 195–217 (14 pls.).

bream. We cannot do more than refer to this interesting study in natural history.

History of the Whale-Shark.*—Barton A. Bean has an interesting story to tell in recounting the history of *Rhinodon typicus* Smith, the whale-shark. It was first known in 1828, when it was captured at the Cape of Good Hope, but has since been recorded from the Indian Ocean, the Gulf of California, the Gulf of Panama, the coast of Florida, and Celebes (?). Unlike other sharks, it has a terminal mouth, and the jaws are provided with ribbon-like dental plates of extremely numerous and minute teeth. It is said to grow to a length of 60 ft., so that it is only surpassed in size by the right whale. The Florida specimen was 18 ft. long. Like the basking shark of the North, it feeds on minute animals, such as Copepods, other Crustaceans, and Molluscs. It is a slow, apathetic fish, harmless to man, and is wont to bask on the surface.

Eye in Selachians.†—V. Franz has made a detailed study of the structure and functional adaptations of the eye in numerous types of Selachians. The general characteristics are the spherical lens, the epithelial lens muscle, the enlarged posterior and diminished anterior bulbus segment, the predominantly cartilaginous sclerotic, the somewhat arched thin and large cornea, the ciliary body, the peculiarly-formed tapetum lucidum, the epithelial iris-musculature, the absence of mesodermic musculature in iris, ciliary body, and choroid, the peculiar zonula zinnii, the absence of a falciform process and vitreous vessels.

The author's discussion of optical, hydrostatic, mechanical, and other adaptations, is of much interest.

Asterolepid Appendages.‡—C. R. Eastman discusses the various interpretations of asterolepid appendages, and points out that the absence of an appendicular skeleton, and the peculiar mode of attachment, offer such striking contrasts to the fins of fishes, as to make it impossible to conceive of a homology existing between them. They may be regarded with much probability as having developed from a muscular flap, or integumentary extension of the body, being of kindred nature with tactile or clasping organs, or with the frontal spines of Chimæroids. The fact that one of the dermal plates is pierced and otherwise modified for their attachment, would seem to indicate that, *pari passu* with the development of body-armour, the paired muscular extensions also become encased in plates. Sphinx-like though the problem be, as to how and when these structures originated, the evidence seems tolerably clear that they are not derivable from fish fins.

New Cephalaspid.§—F. Chapman describes *Thyestes magnificus* sp. n., a new Cephalaspid from the Silurian of Wombat Creek, Australia. It is of great interest, not only on account of its being the oldest recorded vertebrate from Australia, but also because of its large size. The genus *Thyestes* has hitherto been known from small-sized species, but *T. mag-*

* Smithsonian Misc. Collections, xlviii. (1905) pp. 139-48 (3 pls., 2 figs.).
† Jena Zeitschr., xl. (1905) pp. 697–840 (1 pl. and 32 figs.).
‡ Amer. Journ. Sci., xviii. (1904) pp, 141–4.
§ Proc. R. Soc. Victoria, xviii. (1906) pp. 93–100 (2 pls.).

nificus vies with the majority of *Cephalaspis* species. The head-shield is 39 mm. in length by 88 mm. in width.

Thyroid of Myxine.*—J. Schaffer refers to a recent statement by F. J. Cole that "the thyroid of Myxinoids has not hitherto been described." It was briefly described by W. Müller in 1871. Schaffer notes that he re-discovered it in 1896, but refrained from publishing a note when he found Müller's description. A peculiar glandular structure occurs between the branchial pouches in the form of single or grouped spherical or oval vesicles, the walls of which are formed from a single layer of cubical or prismatic epithelium. They occur from the ventral surface of the gullet to the dorsal convexity of the branchial artery and its main branches, and are found from the first to the last pouch. Their development must be known before a final decision can be given, but their median unpaired occurrence and their minute structure (e.g. intracellular inclusions like similar bodies in the thyroid of man) point to their being thyroid (not thymus) elements.

Natural History Notes from St. Andrews.†—W. C. M'Intosh describes a very young stage (35 mm.) of *Phycis blennoides* (captured off Messina), the female Heteronereid of *Nereis pelagica*, specimens of bifid Nemerteans, and gives some notes on *Amphiporus hastatus* M'I., as afforded by a very fine example recently captured at St. Andrews.

Tunicata.

Two remarkable Ascidians.‡—C. Ph. Sluiter makes a preliminary note on two remarkable forms collected by the Siboga Expedition. The first, *Dicopia fimbriata* g. et sp. n., is a simple Ascidian, much compressed from in front backwards; the broad cleft-like branchial aperture is turned upwards, and is surrounded dorsally and ventrally by two very large lobes, into which the muscular layer is continued; the atrial opening is quadrangular and hidden under the large dorsal oral lobe; the under surface of the body bears a wreath of long thin attaching threads; there are no proper stigmata. The second, *Hexacrobylus psammatodes* g. et sp. n., is a simple Ascidian with two apertures almost diametrically opposite one another at the ends of an almost cylindrical body; the branchial aperture is surrounded by a duplicature of the mantle forming six large teat-like prolongations; there are no stigmata; the gonads are paired.

Development of Diplosomidæ.§—Antoine Pizon deals with the formation of the colonies after the embryonic period, that is, after the fixation of the larvæ. He describes the transformation of the oozooid into a bithoracic ascidiozooid, the transformation of the bithoracic ascidiozooid into a monothoracic ascidiozooid, the transformation of the monothoracic ascidiozooid into a bithoracic and biventric ascidiozooid, the doubling of the bithoracic and bigastric ascidiozooid into two monothoracic ascidiozooids with exchange of abdominal viscera, and so on—

* Anat. Anzeig., xxviii. (1906) pp. 65–73 (6 figs.).
† Ann. Nat. Hist., xcvii. (1906) pp. 66–81 (2 pls.).
‡ Tijdschrift Nederland. Dierk. Ver., ix. (1905) pp. 325–7 (2 figs.).
§ Arch. Zool. Expér., iv. (1905) pp. 1–68 (8 pls.).

but the whole story is too complex to be followed without the diagrams and schemata. Moreover, besides the development due to simultaneous epicardio-rectal and epicardio-œsophageal budding, there is another mode in which the budding is exclusively epicardio-rectal.

The Genus Octacnemus.* — W. E. Ritter gives an interesting account of *Octacnemus*, based upon several specimens dredged by the U.S. Fish Commission steamer 'Albatross.' He is able, by means of his study of this fresh supply of material, to correct and supplement some of the statements of Moseley and Herdman, and to give a revised diagnosis of the genus and of the species *O. herdmani*. Undoubtedly the most interesting feature is the branchial sac, which is greatly modified. It is situated within the visceral mass, is functionless as a respiratory organ, but effective as regards nutrition. The stigmata are few, irregular in size, form, and distribution; the dorsal lamina is very short, in the form of two low ridges; the endostyle is likewise short and broad.

Embryology of Pyrosoma.†—A. Korotneff describes the egg and a series of stages in the early development of *Pyrosoma*. The egg is meroblastic; at the 32-celled stage the segmentation becomes equatorial (cf. bony fishes), and gives rise to a many-layered disk. The similarity and parallelism suggest homology with bony fishes, but whether the resemblance is due to mechanical principles, or to a remote relationship, is an open question. The occurrence of a syncytium, which forms a common bed for the blastoderm disk, and which probably arises by an incomplete division of the blastomeres, perhaps points to an ancestry for *Pyrosoma* amongst phylogenetically higher forms. Regarding the budding of the ascidiozooids, the author is at one with Salensky.

INVERTEBRATA.

Mollusca.

β. Gastropoda.

Salivary Glands of Snail.‡—Pacaut and P. Vigier point out that the saliva of *Helix pomatia* results from the mixture of the secretion of the two large salivary glands and that of two other organs discovered by Nalepa in 1883, but apparently overlooked since, unless by Amaudrut (1898).

Nalepa's glands lie symmetrically in the wall of the buccal mass, and consist of a large number of long-stalked, unicellular glands, which open directly and separately into the efferent canals of the salivary glands. The large salivary glands consist of aggregates of unicellular glands imbedded in parenchyma. Both the true salivary glands and Nalepa's glands must be regarded as due to the local differentiation of the same salivary canal, or epithelial invagination.

Habits of Acera bullata.§—R. Legendre describes three modes of locomotion—creeping on the floor, the flight-like swimming, and (on

* Bull. Mus. Compar. Zool. Harvard, xlvi. (1906) pp. 233–52 (3 pls.).
† MT. Zool. Stat. Neapel, xvii. (1905) pp. 295–311 (3 pls., 4 figs.).
‡ Comptes Rendus, cxlii. (1906) pp. 412–14.
§ Arch. Zool. Expér., iv. (1905) Notes et Revue, No. 1, pp. vi.–xiv. (5 figs.).

one occasion) a gliding on the surface with the foot upwards, after the fashion of *Aplysia* and *Lymnæus*. He has studied the copulation, and finds that the same individual may copulate several times in succession, that the animal serving as a male in one copulation may function as a female next time, and that to the same animal which functioned previously as the female. The oviposition occurs about eleven days after fertilisation, and the long, whitish strings are described.

Structure of Oliva peruviana.*—B. Haller gives an account of the coloration of the shell (primarily a uniform yellow-brown, with a thin violet layer underneath this), and describes the nervous, alimentary, excretory, and reproductive systems. In its entire organisation, *Oliva* is not far from Muricidæ and Buccinidæ; it is peculiar in its shell (which has not even a rudiment of an operculum), in its foot, and in other features which mark the genus as near the terminus of a divergent twig. It seems probable that *Olivancillaria* (with an operculum) is one of the oldest forms of Olividæ, and that *Harpa* is older than *Oliva*.

New Genus of Cæcidæ.†—A. Distaso gives an account of a specimen belonging to the family Cæcidæ found at Naples in sand along with *Amphioxus*. It is 2 mm. long, and remained the same size and form for five months, so that it is, very probably, adult. It is made the type of a new genus—*Pseudoparastrophia levigata* g. et sp. n. It has a small shell, which is scarcely recurved, a thin mantle, an almost concave, horny operculum, with spire, two cylindrical tentacles, club-shaped at tip, and bearing long and sensitive cilia.

South Australian Nudibranchs.‡—H. Basedow and C. Hedley report on a number of new Nudibranchs from South Australia, and give a census of the known species, illustrated by 12 plates, mostly coloured.

Antarctic Nudibranchs.§—A. Vayssière reports four Nudibranchs and two Marseniadæ collected by Charcot on the French Antarctic Expedition. There is a variety of *Archidoris tuberculata* Cuv.; a new genus, *Guy-Valvoria*, related to Facelinidæ, Tergipedinæ, and Æolidiadæ; *Notæolidia gigas*, reported by Sir Charles Eliot from the 'Scotia' collection; a new genus, *Charcotia*, related to Æolidiadæ and Tritoniadæ. A new species of *Marseniopsis*, and a new genus *Lamellariopsis* (in the vicinity of *Marseniopsis* and *Marsenina*), represent the Marseniadæ. Thus the small collection is very distinctive.

New Phyllirhoid.‖—Emile André describes *Ctilopsis picteti* g. et sp. n., a new Phyllirhoid from Amboina, which necessitates a slight modification in the diagnosis of the family. The rhinophores are short and large, subconical, united by their bases; the eyes are distinct; the posterior end of the body is truncated; there are three hepatic cæca, two posterior and one anterior; the anus is on the dorsal margin; there

* Jena Zeitschr., xl. (1905) pp. 647–65 (1 pl. and 3 figs.).
† Zool. Jahrb., xxii. (1905) pp. 433–50 (1 pl.).
‡ Trans. Roy. Soc. S. Australia, xxix. (1905) pp. 134–60 (12 pls.).
§ Comptes Rendus, cxlii. (1906) pp. 718–19.
‖ Revue Suisse Zool., xiv. (1906) pp. 71–80 (1 pl.).

is one renal sac, and the renal pore is on the right side; there are three hermaphrodite organs.

Notes on Chitonidæ.*—H. F. Nierstrasz gives a bibliography since 1893, a description of *Lepidopleurus africanus* sp. n., *Chiton* (*Radsia*) *chierchiæ* sp. n., and *Chiton* (*Radsia*) *goodalli* Brod., a discussion of *Ischnochiton rissoi* Payr. and its affinities, and a list of genera showing geographical distribution.

δ. Lamellibranchiata.

Bivalve with Two Mouths.†—Paul Pelseneer points out that in the genus *Lima* there is a right and a left mouth, the primitive single orifice being divided into two by a median coalescence of the lips. In the adjacent genus, *Limatula*, the mouth is single as usual.

Hinge-Plate in Aviculopecten semicostatus.‡—W. Hind has examined a specimen of this species (left valve) from Lower Limestone series, Ayrshire, and has established a character denied for it by its author, McCoy. It possesses a median cartilage pit in the centre of the elongate, somewhat hollow, flattened hinge-plate. The pit is comparatively large and transverse; the rest of the hinge-plate is feebly striated longitudinally; the posterior part of the hinge-line bears a row of erect tubercles. We now know that typical *Pecten* characters existed in Carboniferous times, and that *Aviculopecten*, as at present restricted, is very closely allied to *Pecten*, yet sufficiently distinct to merit a different generic name.

Arthropoda.

α. Insecta.

Treatise on Insects.§—A. Berlese has published thirteen fasciculi of an exhaustive treatise on insects. It is intended for serious naturalists, as may be inferred from the fact that about 300 pages are devoted to the skeletal parts. The first chapter is a short history of entomology, the second deals with the size of insects, the third with the general organisation of the body, the fourth with an outline of the development. After the morphological part is completed, the author will discuss functions, habits, life-histories, and relations to man. The fasciculi before us are copiously and abundantly illustrated, and the text is clear and thorough. But we cannot do more than welcome this important contribution to entomology.

Circulatory System in Insects.‖—Andrei Popovici-Baznosanu has studied this in larvæ of *Chironomus*, *Tanypus*, and Ephemerids, and comes to the following conclusions. The heart of insects is not really chambered, the appearance of chambers being due to the ostial folds. In larvæ of *Chironomus*, the ostia develop from behind forwards by division of the lateral cells of the heart. The "inter-ventricular valves"

* Tijdschr. Nederland. Dierk. Ver., x. (1906) pp. 141-72 (1 pl.).
† Comptes Rendus, cxlii. (1906) pp. 722-3.
‡ Geol. Mag., No. 500 (1906) p. 59.
§ Gli Insetti, fasc. 1-13 (Milano, 1906) pp. 1-392 (4 pls., 448 figs.).
‖ Jena Zeitschr., xl. (1905) pp. 667-96 (1 pl.).

of Chironomids correspond to the anterior ostial folds of Ephemerid larvæ.

On the course of the heart there are areas at which the contraction is strongest, and forms constrictions. The diastolic expansions of the heart are not due to the contractions of the muscles of flight, though they are synchronous with the latter. The fibrils, which extend on the surface of the pericardial septum, are elastic. In the larva of *Cloë*, a ventral diaphragm was observed.

Embiidæ and the Morphology of Insects.*—K. W. Verhoeff has made a study of the Embiidæ—a family of insects to which relatively little attention has hitherto been paid. He has made the thorax a subject of particular investigation, and finds that, as in Japygidæ, it consists of six segments. The limbs, the head, the nerve cord, the abdomen, and the stigmata, are duly discussed.

In a synthetic primitive insect, according to Verhoeff, the body was divided as follows:—

A. Head with six segments .	1. Akron. 2. Antennary segment. 3. Pre-mandibular segment. 4. Mandibular segment. 5. Anterior } maxillary segments. 6. Posterior }
B. Protothorax with two segments . . .	1. Mikrothorax. 2. Prothorax.
C. Deuterothorax with four segments . . .	1. Stenothorax. 2. Mesothorax. 3. Cryptothorax. 4. Metathorax.
D. Proabdomen with fourteen segments . . .	1–7. Main segments, and 1–7. Primitive segments.
E. Medial abdomen with two (or three ?) segments .	8. Abdominal segment (main segment). 9. Abdominal main segment.
F. Postabdomen with four segments . . .	1. Cercus segment (10th abdominal main segment). 2. Pygidium } 3. Metapygidium } Opisthomeres. 4. Telson }

Verhoeff divides Enderlein's order, Isoptera, into two sub-orders:—A. Termitina, the termites; and B. Adenopoda (including the single family Embiidæ, and the single genus *Embia*).

Life-History of Litomastix truncatellus.†—F. Silvestri gives an account of this parasitic Hymenopteron, which lays its eggs in those of

* Nova Acta Leopold-Carol. Acad. Halle, lxxxii. (1904) received 1906, pp. 145–205 (4 pls.).

† Ann. Scuola Agricoltura Portici, vi. (1906) pp. 1–51 (5 pls., 13 figs.).

Plusia gemma. In the oocyte of the first order, the chromatin of the nucleus is separated from the nucleolus; the nucleolus passes to one of the first four blastomeres, and thence onwards; the maturation is identical in the parthenogenetic and fertilised ova, two polar bodies being formed. The first polar body divides into two: these unite with one another and with the second polar body, to form a "polar nucleus," which multiplies by mitosis, giving rise to numerous nuclei immersed in the polar ooplasm. About a half, or a third, of the ovum remains undivided, and forms an envelope for the embryonic cells.

There is poly-embryony, for each egg gives rise to about a thousand sexual larvæ, and a hundred asexual larvæ. The former become adults; the others, which are very rudimentary, perish. Each embryo is surrounded by a double envelope, partly due to the ooplasm and polar nuclei, and partly to a stratum of cells, delaminated off from the embryonic morula. The female pronucleus is capable of developing of itself and giving origin to males only. The fertilised ova develop into females.

Stomach of Wood-Bee.*—E. Bugnion gives a detailed account of the stomach of *Xylocopa violacea*, and compares it with that of the hive-bee, the humble-bee, and the wasp.

Palæarctic Bassides.†—Claude Morley has revised the Ichneumonidous group Tryphonides schizodonti, of which he gives a tabular synopsis, together with notes on the synonymy, economy, and distribution in Britain, as well as descriptions of new species. The palæarctic fauna now includes more than sixty species.

Artificial Parthenogenesis in Ova of Silk Moth.‡—E. Quajat has continued the experiments of Tichomiroff and Verson. He found that when unfertilised ova were subjected to various kinds of stimuli—oxygen, increased temperature, sulphuric acid, hydrochloric acid, carbon dioxide, and electricity—development was induced in many cases, and sometimes continued till a larva was formed. Some ova were unaffected and died, and some unstimulated, unfertilised ova showed beginnings of development. The author proposes to continue the experiments, and to make them more precise.

Lepidoptera of Morocco.§—E. G. B. Meade-Waldo gives an account of Lepidoptera collected in extensive journeys in Morocco. Special attention was given to high mountain species. An analysis of the list shows how very few species there are in these remote regions that are not also to be found in the Mediterranean region, and that these mountains have developed comparatively few Alpine species.

Number of Facets in Beetles' Eyes.‖—K. Leinemann has had the patience to count the number of facets in the eyes of 150 species of

* MT. Schweiz. Entomol. Ges., xi. (1905) pp. 109–28 (4 pls.).
† Trans. Entomol. Soc. London (1905) pp. 419–38.
‡ Atti R. Accad. Sci. Padova, xxi. (1905) No. 3, 16 pp. See also Zool. Zentrabl., xiii. (1906) pp. 108–9.
§ Trans. Entomol. Soc. London, 1905, pp. 369–93 (2 pls.).
‖ Dissertativ. München., 1904, 64 pp. See also Zool. Zentralbl., xiii. (1906) pp. 191–2.

beetle. In the same species and sex the number increases with the size of the body; there is usually no permanent difference between the sexes, but the numbers for one eye in the male and female are 2500 : 300 in *Lampyris splendidula*, 5300 : 4850 in *Melolontha vulgaris*, 2200 : 1800 in *Saperda carcharias*. The number is greater in the rapidly moving active forms, smaller in the sluggish forms. It is not reduced in nocturnal forms, as the instance of *Necrophorus germanicus* ♂, with 24,000 facets, shows.

Blind Coleoptera of Australia.*—Arthur M. Lea gives notes on all the known species in Australia and Tasmania. None have been taken in caves; they occur principally under stones, or at the roots of beach-growing plants. The number of species is eight—probably far short of the total to be obtained—and all are of small size, with the body apterous, and elytra soldered together.

Insects Injurious to Cocoanut Palm.†—Charles S. Banks describes the rhinoceros beetle (*Oryctes rhinoceros*), the Asiatic palm weevil (*Rhychophorus ferrugineus*), and some other weevils, discussing their life-history, the damage they do, and remedial measures.

Sensory Organs on Wings.‡—G. Noè calls attention to the presence of distinct sensory structures on the convex surface of the nervures of the wings in species of the Dipterous genera *Mycterotypus*, *Culex*, *Chironomus*, *Calliphora*, etc.

New York Mosquitos.§—E. Porter Felt discusses the diversities in the structure and habits of adult and larval mosquitos in the New York State. He indicates the theoretical interest and practical importance of these diversities, and how much still requires to be done in regard to the group. The features of numerous species are beautifully illustrated.

Blood-Sucking Muscidæ.‖—K. Grünberg describes *Glossinella schillingsi* g. et sp. n., from German East Africa, and discusses the genera *Stomoxys*, *Hæmatobia*, *Lyperosia*, *Beccarimyia*, *Glossina*, bringing together in a convenient form the scattered diagnoses. He also reports on some new species of *Stomoxys* from Africa, and on the distribution of the species of tsetse fly.

Effects of Parasites on Oocytes of Queen Termite.¶—G. Brunelli calls attention to the interesting fact that in queens of *Termes lucifugus* and *Calotermes flavicollis* infected with Protozoon parasites in the intestine, there is a correlated destruction of oocytes—a sort of indirect parasitic castration.

Wing-Structure in Cicads.**—O. E. Imhof discusses the details of the wings—ribs, joints, folds, etc.—and their insertions on the thorax.

* Trans. Entomol. Soc. London, 1905, pp. 365–8.
† Philippine Journ. Sci., i. (1906) pp. 143–67 (10 pls.).
‡ Atti Rend. R. Accad. Lincei Roma, xiv. (1905) pp. 721–7 (4 figs.).
§ Proc. Second Anti-Mosquito Convention, New York, 1906, pp. 1–32 (14 pls. and 6 figs.).
‖ Zool. Anzeig., xxx. (1906) pp. 78–93 (15 figs.).
¶ Atti Rend. R. Accad. Lincei Roma, xiv. (1905) pp. 718–21 (1 fig.).
** Zeitschr. wiss. Zool., lxxxiii. (1905) pp. 211–23 (2 figs.).

The data tabulated and classified are derived from the study of twenty-two genera, and a family diagnosis of fore and hind wings is given.

β. Prototracheata.

Monograph on Onychophora.*—E. L. Bouvier continues his monograph on this interesting order, and deals with species of *Peripatus*, *Eoperipatus*, *Peripatoides*, *Paraperipatus*, *Opisthopatus*, and *Peripatopsis*. Special mention may be made of the very successful coloured plates.

δ. Arachnida.

Habits of Pseudoscorpionidæ.†—E. W. Berger gives an interesting account of his observations on these animals, especially on *Chelanops oblongus* Say. Their wide distribution, especially north and south, is probably due to their association with migratory insects. Their association with insects takes various forms: simply for transport, or as commensals, or as parasites. Most pseudoscorpions feed on the juices of insects and mites smaller than themselves, but Berger found evidence of cannibalism in *Chelanops*. Casting or moulting nests are built by single immature individuals for a safe retreat during moulting. Regeneration of part of the pedipalps occurs.

Coloured Skin Secretion in Opilionidæ.‡—J. C. C. Loman describes from the skin of species of *Gagrella* a coloured secretion which is emitted from the chitin pores. No trace of gland-cells could be found. Its significance to the animal, whether protective in a similarly coloured environment, or rendering it nauseous to the taste, is undetermined.

New Classification of Acarina.§—A. C. Oudemans describes in *Labidostoma denticulatum* the hitherto unknown tracheal system of Labidostomidæ. He found two dead specimens in which the soft parts had rotted away, leaving (after the dorsal shield was removed) a fine preparation of the tracheal system. The stigmata have a unique position—beneath the mandibles, one on each side of the mouth. It is interesting also to note that each specimen contained two fresh ova.

A new classification of Acari is based on the tracheæ and stigmata.

Sub-class 1. Distigmata.
Orders—Metastigmata, Mesostigmata, Parastigmata, Antistigmata, Heterostigmata, Stomatostigmata, and Prostigmata.

„ 2. Octostigmata.
Order—Cryptostigmata (= Oribatidæ).

„ 3. Astigmata (= Sarcoptidæ).
Orders — Diacrotricha, Monacrotricha, Anacrotricha.

„ 4. Lipostigmata.
Order—Demodicides.

„ 5. Xemiostigmata.
Order—Tetrapodili (= Eriophyidæ).

* Ann. Sci. Nat. (Zool.) ii. (1905) pp. 241–383 (13 pls. and figs. 97–140).
† Ohio Naturalist, vi. (1905) pp. 407–19 (1 pl. and 1 fig.).
‡ Zool. Jahrb., xxii. (1905) pp. 755–8 (1 pl.).
§ Zool. Anzeig., xxxix. (1906) pp. 633–7 (1 fig.).

Holothyrids.*—Karel Thon has studied *Holothyrus braueri* sp. n., a representative of the poisonous Acarina (Holothyridæ) from islands in the Indian Ocean. It is uncertain whence the poisonous secretion comes, but the author gives reasons in favour of referring it to the *pedal* glands on the third appendage. He describes the whole glandular system—the cheliceral, maxillary, pedal, coxal, and crural glands. The simple crural glands, like those of *Peripatus*, are new discoveries. He regards *Holothyrus* as a highly developed form on a phyletically young twig of the Acarine stem, and the segmental disposition of the anterior portions of the body as a secondary acquisition.

Notes on Structure of Ixodes.†—A. Bonnet describes (1) the apparently sensory "porous area," a paired finely punctate depression on the dorsal surface towards the base of the rostrum in females only; (2) the simple eyes which are marked by the thickness of the cornea, the black pigment in the crystalline lens, the absence of pigment between the retinal cells and on the margin of the vitreous body, and by the large size of the nerve-cells; (3) the pyriform poison-cells included in the salivary glands.

Tick Fever in Congo Free State.‡—R. Newstead gives notes on the distribution, bionomics, and external features of *Ornithodoros moubata*, the carrier of the parasite—probably *Spirochæta obermeieri*—of tick fever. *Ornithodoros* is not simply a mechanical carrier, but acts as host, the spirochæte undergoing development within it. It is pointed out that the adult female of this species may be easily distinguished from *O. savigny* not only by the absence of the eyes (Pocock's test), but also by the presence of an inner two-toothed apophysis and the apparently narrower basis of the hypostome. Details regarding the metamorphosis and egg laying are also given.

Feeding Habits of Pycnogonids.§—Léon J. Cole has studied *Anoplodactylus lentus*, abundant at Woods Hole on *Eudendrinm ramosum*. It has always been the natural inference that the Pycnogonid obtained its food from the hydroid; the author found that it probably does not suck the juices of the hydroids at all, but was observed eating off the hydranths. When the Pycnogonid came into contact with a hydroid head, the latter was firmly seized with the chelæ, and appeared to be forced slowly into the mouth. The Pycnogonid then pulled till the hydranth broke off, when it was gradually consumed, the chelifori aiding in the process by helping to force the hydranth into the mouth. Sometimes the hydranth was broken up more or less by the chelæ, and the pieces then appeared to be sucked in.

Antarctic Pycnogonids.‖—E. L. Bouvier discusses the Pycnogonids collected by Jean Charcot on the 'Français' Antarctic Expedition.

1. Decapod Pycnogonids seem to be abundantly represented in

* SB. k. Böhm. Ges. Wiss., x. (1905) pp. 1–41 (2 pls.).

† Comptes Rendus, cxlii. (1906) pp. 296–8.

‡ Liverpool School of Tropical Medicine, Memoir xvii. (2 pls.). See also Centralbl. Bakt. Parasit., xxxviii. (1906) pp. 9–10.

§ Zool. Anzeig., xxix. (1906) pp. 740–1.

‖ Comptes Rendus, cxlii. (1906) pp. 15–22.

southern regions by species of two distinct genera, *Decalopoda* and *Pentanymphon*.

2. The genus *Decalopoda* is represented by two species, *D. australis*, common off the South Shetlands, and *D. antarctica*, found by Charcot nearer the pole.

3. The genus *Pentanymphon* is widely distributed around the Antarctic continent, and the known species, *P. antarcticum*, becomes more abundant as one goes farther south.

4. The octopod Pycnogonids of the genera *Cordylochete* and *Ammothea* are abundant in the south, as in the north. The Ammotheidæ are especially common, and none of their representatives are of large size.

Classification of Pantopoda.*—Wl. Schimkewitsch discusses this in detail, but we cannot do more than refer to a few points. The genera *Nymphopsis* Haswell, *Eurycyde* Schiödte, *Ammothella* Verrill and Cole, and Dohrn's *Ammothea appendiculata*, are near the hypothetical primitive ancestor which he calls *Oronymphon*. He thinks that *Pentanymphon* and *Decalopoda* (which have five pairs of legs) may be regarded as neotænic forms of genera with the usual four pairs. The chief part of the paper illustrates what the author calls the "periodicity" of types: thus there are forms with a 3-jointed first appendage, and with 10, 9, 8, 7, or fewer joints in the second appendage; there are forms with a 2-jointed first appendage, and with 10, 9, 8, 7, 6, 5, or fewer joints in the second appendage. So the author constructs tables which recall the Periodic Law in chemistry, and in any case illustrate the gradualness of morphological changes.

Structure and Position of Tardigrada.†—Albert Basse has been able to overcome the difficulties in the way of sectioning these small animals, and gives an account of the integument, alimentary system, blood, musculature, nervous system, and gonads, with especial reference to species of *Macrobiotus*. The author regards the Tardigrada as near the base of the Arthropod stem. With Tracheata they are united by a number of characters: the clawed appendages (jointed in *Lydella*, with at least one joint in *Macrobiotus hufelandi*), the presence of Malpighian tubules, the nature of the exoskeleton, musculature, nervous system, and intestinal glands, the presence of antennary nerves, the probably paired nature of the genital apparatus, and the differentiation of the ovary into germinal and nutritive portions.

Chitin in Carapace of Pterygotus osiliensis.‡—Otto Rosenheim finds that the general behaviour of the substance of the carapace of this Silurian Eurypterid towards acids and solvents is such, that it is probably chitin; and this is confirmed by the fact that, after such treatment, it yielded on hydrolysis with concentrated hydrochloric acid, a strongly reducing substance which is presumably glucosamine.

ε. Crustacea.

Hermaphroditism in Crayfishes.§—William P. Hay notes that some degree of hermaphroditism has been recorded in *Homarus vulgaris*,

* Zool. Anzeig., xxx. (1906) pp. 1–22 (3 tables).
† Zeitschr. wiss. Zool., lxxx. (1905) pp. 259–81 (2 pls. and 1 fig.).
‡ Proc. Roy. Soc., lxxvi.. series B (1905) No. B 511, pp. 398–400.
§ Smithsonian Misc. Collections, xlviii. (1905) pp. 222–8 (1 fig.).

Astacus fluviatilis, *Parastacus*, and in the genus *Cambarus*. To the list which he gives and comments on, he adds four cases in *Cambarus spinosus* and *C. affinis*. "It would appear that in the genus *Cambarus* at least, hermaphroditic individuals are females, which, owing to some ambiguity of the formative cells of the embryo, have developed to a greater or less degree the characters of the opposite sex. The condition is a very rare one, and is usually shown in the external organs only."

Phylogeny of Crustacean Limb.*—J. Thiele makes some observations on this subject. He concludes that the primitive form which is to be traced to the annelid parapodium might be regarded as a blade of two segments, whose proximal part was imperfectly separated from the body, and whose musculature was derived from it, while the distal division—as yet unsegmented—carried a dorsal, leaf-shaped appendage. Such a type is approached most nearly in the thoracic leg of *Nebaliella*. Here the basale and endopodite are together homologous with the original distal segment.

Crustacea of the Forth Region.†—Thomas Scott gives a catalogue of the Malacostraca, Cladocera, and Branchiura found in the basin of the River Forth and its estuary. There are 19 species of Brachyura, 33 of Macrura, 26 of Schizopods, 21 of Sympoda (Cumacea), 42 of Isopods, and 145 of Amphipods, making a total of 286 Malacostraca. Of Branchiopoda, 55 species are noted, and the second part of the catalogue, which will deal with Ostracods (about 132 species), Copepods (about 300 species), and Cirripedia (about 13 species), will raise the total to about 786 species, which is a fine record of faunistic work in a limited Scottish area.

Variation-Study of a Decapod.‡—Arthur Brožek has made a detailed study of the variations in the external characters of *Atyaëphyra desmarestii* Joly, dealing especially with rostrum, spines, and all the appendages.

Monograph of North American Isopods.§ —Harriet Richardson deserves to be congratulated on her monograph of North American Isopods—including sea-shore, fresh-water, terrestrial, cavernicolous, and parasitic forms. The tribes, or super-families, dealt with, are:—Tanaioidea, or Chelifera; Cymothoidea, or Flabellifera; Idotheoidea, or Valvifera; Asselloidea, or Asselota; Bopyroidea, or Epicaridea; and Oniscoidea. While the object of the work is to give descriptions and figures of the known species of North American Isopods, the author has not forgotten the perennial interest of habits and behaviour, and she has effectively completed a big piece of work for which many zoologists will be grateful.

Monograph on British Wood-Lice.‖—W. M. Webb and C. Sillem have done a useful piece of work in preparing this monograph of the

* Zeitschr. wiss. Zool., lxxxii. (1905) pp. 445–71 (2 pls. and 1 fig.).
† Proc. Roy. Phys. Soc. Edinburgh, xvi. (1906) pp. 97–190 (1 map).
‡ SB. k. Bohm. Ges. Wiss., i. (1905) pp. 1–69 (32 figs., 2 tables).
§ Bull. U.S. National Museum, No. 54 (Washington, 1905) liii. and 727 pp., 740 figs.).
‖ The British Woodlice: being a Monograph of the Terrestrial Isopod Crustacea occurring in the British Islands. London (1906) x. and 54 pp., 25 pls. and 59 figs.

terrestrial Isopods occurring in the British Islands. After an introduction dealing with the structure, development, and habits of wood-lice, the authors give a systematic account of 25 species belonging to the following genera:—*Ligia*, *Ligidium*, *Trichoniscus*, *Haplophthalmus*, *Oniscus*, *Philoscia*, *Platyarthrus*, *Porcellio*, *Metoponorthus*, and *Armadillidium*. We would commend this welcome monograph—which is beautifully illustrated—to the attention of naturalists.

Regeneration of Antennæ of Wood-Louse.*—Josef Ost finds that the whole antenna of *Oniscus murarius* is regenerated in three weeks when it is excised at the base. The details of the process are described. When more than half of the basal joint is cut, autotomy follows. Hitherto undescribed antennary glands are noted.

Affinities of Hoplophoridæ.†—H. Coutière discusses the multiple affinities of the deep-sea family, Hoplophoridæ, with the higher Schizopods (Lophogastridæ), with the Euphausidæ, and with the Penæidæ.

Distribution of Gennadas.‡—E. L. Bouvier discusses the facts bearing on the depth distribution of *Gennadas elegans* and other species. It seems that *Benthesicymus* is, in the strict sense, abyssal, and that *Gennadas* is "bathypelagic," not normally occurring at the bottom, or in its immediate neighbourhood.

Relationships of Gennadas.§—E. L. Bouvier discusses the differences between *Gennadas* and *Benthesicymus*, and gives an account of six species of the former. The genus *Gennadas* is derived from *Benthesicymus* by adaptation to a bathypelagic mode of life, and the two genera are linked by *G. carinatus* S. I. Smith and *G. alicei* sp. n.

Phagocytosis and Excretion in Phyllopods.‖—L. Bruntz has experimented with a large Branchipod, *Chirocephalus diaphanus*, and finds that in phagocytosis two kinds of elements are active—(1) the young blood-corpuscles ("microphages"), and (2) large fixed phagocytic and excretory cells ("macrophages"). The latter occur throughout the body, but are especially abundant in the dorsal regions of the head and abdomen, in the latero-dorsal region of the thorax, and in the thoracic appendages; they are always on the course of blood channels. In the process of excretion, three sets of structures are operative: (1) the maxillary glands, (2) the large phagocytic cells mentioned above, and (3) the anterior cæca of the gut.

Parthenogenesis of Artemia salina.¶—C. Artom has investigated the question of the parthenogenesis of *A. salina*, and finds that at Cagliari there is none. Virgin *Artemia* were kept under observation for five months, during which time the eggs in the ovarian sac underwent no change, whilst fecundated eggs placed approximately in the same conditions, developed in four weeks. The males of *Artemia* at Cagliari

* Zool. Anzeig., xxix. (1906) pp. 687–94.
† Comptes Rendus, cxli. (1905) pp. 219–22.
‡ Tom. cit., pp. 686–90. § Tom. cit., pp. 748–50.
‖ Arch. Zool. Expér., iv. (1905) pp. 183–98 (1 pl.).
¶ Biol. Centralbl., xxvi. (1906) pp. 26–32.

are more numerous than the females; here, *Artemia* is viviparous in winter, when, in most localities, it is oviparous.

Artemia salina.*—C. Artom replies to Loeb's criticism of Schmankewitsch's experiments on *Artemia salina*, and indicates some mistakes which the American physiologist has made. He states the following facts:—(1) There are forms of *Artemia* probably parthenogenetic, which live in fresh water, which remain *Artemia*, and do not become "*Branchipus*;" (2) there are forms of *Branchipus* (*B. ferox* and *B. spinosus*) which live in salt water, which probably are not parthenogenetic, which remain *Branchipus*, and do not become "*Artemia*"; (3) there are forms of *Artemia* which live in brine-pool water, which are not parthenogenetic, in spite of the osmotic pressure to which the eggs are subjected in such localities.

Cervical Cap in Nauplius of Artemia salina.†—Nicolas de Zograf describes the rounded cap, or "calotte," which occurs as an embryonic organ on the cervical region and posterior part of the head in the nauplius of *Artemia*. It has been noted by others in *Branchipus* and *Limnetis*, but no detailed description has hitherto been given. The most interesting point is that under the chitinous covering there lies a ring of cells, with a nervous reaction when treated with the methods of Golgi and Ramon y Cajal.

Reduction of Eyes in Gammarids.‡—F. Vejdovský calls attention to the interest of W. F. de Vismes Kane's observation that some specimens of *Niphargus kochianus* from Lough Mask showed some optic pigmenation. Along with the specimens sent from Lough Mask, there were four which are referred by Vejdovský to a new genus between *Crangonyx* and *Niphargus*, and a description of this *Bathyonyx de Vismesi* g. et sp. n., is given. The author discusses the state of the eyes in *Gammarus*, *Crangonyx*, and *Niphargus*. The interest of *Bathyonyx* is that it represents the first stage in degeneration of the eyes. Vejdovský also discusses the relations between *Niphargus kochianus* Bate, and *N. caspary* Pratz.

Indian Stalked Barnacles.§—Nelson Annandale makes a preliminary report on the stalked barnacles collected by the 'Investigator.' The collection includes six new species of *Scalpellum*, besides *Megalasma striatum* sub-sp. *minus* nov., and *Alepas xenophoræ* sp. n.

Leposphilus labrei.‖—A. Quidor has studied this parasite of the lateral line of *Labrus donovani*. The adult female was discovered by Hesse in 1866, the male by Carl Vogt in 1879. The author shows that the body of the male consists of a head, five thoracic, and five abdominal segments. Thus the family Philichthydæ are typical and old-fashioned Copepods. There is little difference between the male and the young female in *Leposphilus labrei*. Parasitism brings about a reduction of appendages, for the adult female has none, while the male has three pairs.

* Biol. Centralb., xxvi. (1906) pp. 204-8.
† Comptes Rendus, cxli. (1905) pp. 903-5.
‡ SB. k. Böhm. Ges. Wiss., xxviii. (1905) pp. 1-40 (2 pls., 11 figs.).
§ Ann. Nat. Hist., xvii. (1906) pp. 389-400.
‖ Comptes Rendus, cxlii. (1906) pp. 230-2.

Antarctic Copepods.*— A. Quidor makes a brief report on the Copepods collected by Charcot on the 'Français' Antarctic Expedition. Besides several forms obtained by the 'Belgica,' the 'Français' Expedition obtained a number of interesting new species, e.g. *Phyllopus turqueti*, *Porcellidium charcoti*, *P. affinis*, and *Anchorella intermedia*.

Annulata.

Œsophageal Pouches in Polygordius and Saccocirrus.†—W. Salensky reports the interesting fact that in these primitive forms there are two pairs of diverticula from the gullet, which open independently to the exterior. The anterior pair are grooves, not well-defined pouches, but their relations with gut are precisely similar to those of the posterior pouches. Both may be regarded as homologous with the gill-pouches of *Balanoglossus* and Chordata. This affords another argument for the thesis that Vertebrates are derived from Annelids.

Red Sea Polychæts.‡—Ch. Gravier makes a note on the collection of Polychæts made by Jousseaume, Coutière, and himself, from the Red Sea. It includes 116 species (70 new) in 66 genera (5 new), and when those previously described are counted in, a total of about 170 species is reached. Most noteworthy is the dependence on the Indian Ocean Polychæt fauna, but some of the Red Sea species are also known from the western coast of Africa. A number of Atlantic and Mediterranean forms have, so to speak, surrounded the African coast, both east and west. Even for relatively sedentary animals, the "zoological provinces" are seen to fuse more and more as our faunistic knowledge increases.

Peculiar Regenerative Process in Potamilla.§—Arnold T. Watson has made the interesting observation that portions of a rock-boring species of *Potamilla*, bereft of head and thorax, and consisting of abdominal segments only, exhibited a power of economising labour and material by changing the arrangement of certain of the old parts, so as to complete the model of the original animal. Besides the cephalic plume-bearing segment, one new setigerous thoracic segment only was formed, but the chætal plan of the succeeding five or nine abdominal segments was changed; the dorsal uncini in these segments first disappeared and gave place to setæ, and later the ventral setæ were replaced by uncini; the new setæ and uncini, moreover, were changed to the forms characteristic of this part of the body. In other words, so far as the chætal plan is concerned, a new thorax was constructed from the old abdomen. In another case (*Sabella pavonina*) the number of abdominal segments transformed corresponded exactly with that of the thoracic region of the worm from which the abdominal segments were excised. The author also calls attention to the fact that the worms can themselves provide ligatures and so sever the body at any given point.

* Comptes Rendus, cxlii. (1906) pp. 54–6.
† Biol. Centralbl., xxvi. (1906) pp. 199–204 (3 figs.).
‡ Comptes Rendus, cxlii. (1906) pp. 410–12. See also Nouvelles Archives du Museum, 1900, 1901, 1906 (18 pls. and 495 figs.).
§ Proc. Roy. Soc., series B, lxxvii. No. B 518 (1906) pp. 332–6 (4 figs.).

Mistaken Case of Budding in Polychæts.*—Ch. Gravier has rediscovered a Terebellid in which a peculiar mode of asexual reproduction was described by Vaillant in 1865. Vaillant thought that buds were given off from a membranous lobe in the vicinity of the mouth, but Gravier finds that the buds are only the tentacles! The animal, which Vaillant did not name, is designated by Gravier *Anisocirrus decipiens* g. et sp. n.; it belongs to the sub-family Polycirridea. It was found at various places in the Gulf of Tadjourah.

Alaskan Polychæts.†—J. Percy Moore deals with five new species of *Pseudopotamilla* from the Pacific coast of North America, which are of interest in indicating the inter-relations of the genus with *Eudistylia* and *Sabella*.

Nephridia of Aeolosoma and Mesenchytræus.‡—F. Vejdovský notes that in *Aeolosoma* the nephridia vary not only in different segments, but on different sides of the same segment. Both the ascending and descending canals of the nephridium are intracellular. The anterior segments have the most complex nephridia (with nephridiostome, glandular loop, and efferent duct); there is progressive simplification posteriorly. In *Mesenchytræus* there is also notable variability in the nephridia. The author shows that there is no warrant for supposing that *Aeolosoma* can liberate its genital products by normal nephridia. There are true gonoducts, and the whole system is after the Oligochæt type.

Relationships in Oligochæta.§—F. Smith discusses the systematic position of *Thinodrilus inconstans* Smith. A detailed comparison of this species with those of the other genera has led the author to place it in the genus *Lumbriculus*, which genus, together with its two species, *L. variegatus* O. F. Müller, and *L. inconstans* Smith, are re-defined.

Italian Oligochæta.‖—R. Issel describes fifteen species of Enchytræidæ from Val Pellice, five of which are new to science. Some points bearing on taxonomy are raised in the study of this fresh material. For example, the diverticula of the spermatheca are variable, as in *Fridericia aurita*, where there are three instead of the usual two, therefore these cannot furnish an absolute criterion for taxonomy. Apropos of numerical variations, it is noted that in *Mesenchytræus gaudens* there are typically four masses of septal glands; in the hill variety there are five, and in the mountain form seven. In *Fridericia* mature and immature individuals were found promiscuously, but in *Marionina* and *Mesenchytræus* only immature forms, and that only at certain determinate periods. There is a brief sexual period, during which only the reproductive organs are in a state of complete development.

Blood Vessels of Sipunculus nudus.¶—P. Enriques criticises the conclusions of Ladreyt as to the functions of the blood vessels in this

* Comptes Rendus, cxli. (1905) pp. 905–6.
† Proc. Acad. Nat. Sci. Philadelphia, 1905, pp. 555–69 (1 pl.).
‡ SB. k. Böhm. Ges. Wiss., vi. (1905) pp. 1–11 (1 pl.).
§ Bull. Illinois Lab. Nat. Hist., vii. (1905) pp. 45–51.
‖ Zool. Jahrb., xxii. (1905) pp. 451–76 (2 pls.).
¶ Arch. Zool. Expér., iv. (1906) Notes et Revue, No. 2, pp. xxiii–vi.

Sipunculid. The alleged hæmatolytic function of the posterior part of the ventral tube is an error of interpretation; the lymphogenic function of the interior part of the dorsal canal was recognised by the author before Ladreyt had published his paper;* the alleged excretory function of the posterior part of the gland is a mistaken inference from the presence of uric acid; one might as well say that all the organs of Selachians are excretory because they contain abundant urea.

Abnormality in Genital Organs of Leech.†—Jules Bourquin describes an abnormal doubling of the female genital organs of *Hirudo medicinalis*. Each part consists of a vagina, an oviduct, and a single ovary. The more anterior of the two opens as usual between the 29th and 30th ring, and its missing right ovary has its place taken by a spiral canal which runs into contact, if not into connection, with the right vas deferens. The posterior organ—opening between the 34th and 35th rings—has been pushed to the right by the first testis on the left side, and the corresponding first testis on the right side is missing.

Digestion in the Leech.‡—C. Spiess discusses the role of the pigmented cells found surrounding the digestive tract in *Hirudo medicinalis*. Moquin-Tandon spoke of them as "hepatic tissue;" others have shown that they play an active part in the elimination of products of dis-assimilation. Spiess points out that the cells in question are not derived from the mesenteron, and do not morphologically correspond to a beginning of a hepatic gland. They correspond rather to a kidney, but they fulfil as such part of the functions which in Vertebrates fall to the hepatic cells. The biliary pigments found in the leech are due to the hæmatin of the blood which has been ingested.

Systematic Relations of Chætognatha.§—Paul Abric discusses different types of Chætognatha, witb especial reference to the fins. In *Scottochætus*, the system of fins (paired and caudal) is continuous; in *Krohnochætus*, the continuity of paired fins with the unpaired fin is broken; in *Lyrochætus*, the lateral fins are divided into two, and so on. But these morphological series do not in any way represent the real evolutionary series. "Morphological resemblances, however precise they may be, ought not to lead us to prejudge the question of phylogenetic affinity."

Nematohelminthes.

Family Mermithidæ.‖—E. Corti discusses *Paramermis contorta* Kohn, and proposes the following division of the family Mermithidæ:

Sub-family		Muscular fields	Spicules	Papillæ
Mermithinæ (cuticle with crossed fibres)	Neomermis, v. Linst, 1904 .	2	2	10
	Mermis, Duj., 1842 . .	6	2	6
	Paramermis, v. Linst, 1898	6	1	6
Hydromermithinæ (simple cuticle)	Hydromermis, E. Corti. 1902	8	1	6
	Pseudomermis, De Man, 1903	?	?	4

* Arch. Zool. Expér., iii. (1905) Notes et Revue, No. 4, pp. ccxv–ccxxiii.
† Rév. Suisse Zool., xiv. (1906) pp. 47–9 (1 fig.).
‡ Arch. Sci. Phys. Nat., xx. (1905) pp. 592–4.
§ Comptes Rendus, cxli. (1905) pp. 222–4.
‖ Zool. Anzeig., xxix. (1906) pp. 627–31.

Notes on Anchylostomum.*—Gino Pieri finds that *Anchylostomum duodenale* may infest dogs, may attain in these hosts to the adult reproductive stage, and may pass into the intestine by oral infection as well as cutaneously.

Biology of Filaria bancrofti, Cobbold.†—N. Taniguchi records from the island of Kiushiu frequent cases of swelling of lymphatic glands, elephantiasis, and chyluria, in which *Filaria* embryos are present in the blood mostly during night, but in daytime also. The embryos vary from 0·16 to 0·31 mm. in length; in breadth they measure between 0·04 and 0·08 mm. They are for the most part carried by *Culex pipiens*, rarely by *Anopheles*, and not by fleas or lice. As soon as the embryos enter the stomach of *Culex*, they are in some cases digested; in others, within 24 hours, they reach the thorax, and there commence metamorphosis. In from 11 to 14 days they arrive at the labium of the mosquito, and on the stinging of the human body are liberated into the wound. They are possibly also transmitted by being deposited upon fruits when these are sucked by *Culex*, and subsequently transferred to an unsound human stomach. No explanation of their appearance mostly by night has been found. It is noted that Röntgen rays disturb the appearances of the embryos, and lessen their lively movements.

Platyhelminthes.

Pearl-Producing Cestode.‡—L. G. Seurat finds that in pearl-oysters (*Margaritifera margaritifera* var. *cummingi*, Reeve) from the Gambier lagoons (South Pacific) the production of pearls is due to the scolex of a Cestode referable to the genus *Tylocephalum* Linton. In latero-dorsal cysts on the body and mantle of the oyster true pearls are formed around a nucleus, which is demonstrably a scolex. The life-history seems to be continued in the ray (*Aetobatis narinari*), for in the spiral intestine of this fish small tapeworms were found, which the author regards as the adult forms of the pearl parasite (*T. margaritiferæ* sp. n.). The rays appear to have a preference for those pearl oysters whose shells are riddled by the sponge *Clione*.

The genus *Tylocephalum* is represented by another species in the spiral valve of *Rhinoptera quadriloba*.

Tænia acanthorhyncha, Wedl.§—Al. Mrázek describes this remarkable tapeworm from *Colymbus fluviatilis*. The vagina remains blind; a new secondary female genital opening is formed; there is a free communication between the receptaculum seminis in one proglottis and that of the succeeding proglottis. This is a quite unique feature. Kowalevsky's *Tatria biremis* is a closely allied species.

Life-History of Cyathocephalus truncatus.‖—R. Wolf finds that this Bothriocephalid, adult in fresh-water fishes, has its larval form in *Gammarus*. The larva differs but little from the sexually mature

* Atti Rend. R. Accad. Lincei Roma, xiv. (1905) pp. 727–30.

† Chiusei Iho, West Japan, 1905. See also Centralbl. Bakt. Parasit., xxxvii. (1906) p. 752.

‡ Comptes Rendus, cxlii. (1906) pp. 801–3.

§ SB. k Böhm. Ges. Wiss., vii. (1905) pp. 1–24 (2 pls. 7 figs.).

‖ Zool. Anzeig., xxx. (1906) pp. 37–45 (5 figs.)

animal, the most striking characteristic being the pear-shaped terminal appendix, in which the excretory system opens to the exterior by lateral ducts. The ova are not liberated from abstracted joints, but pass out by the female genital aperture, and are included in the fæcal balls of the host.

Monozoic Nature of Cestoda.*—J. W. Spengel discusses the descent of the Cestodes and the question of their individuality. They are single animals. Some of his proofs may be quoted. There are cerebral ganglia in the scolex; in the proglottides corresponding central organs are absent. All metazoa which form colonies have in a great degree the power of regeneration; this has never been observed in Cestoda, while its absence is proved by the frequently described "fenestræ," or perforations occurring in very young segments. The formation of proglottides is regarded as originally independent of the segmentation of the sexual apparatus—both coincide only in the higher Cestodes. They owe their origin to the locomotor activity of the free hinder border of the original proglottis. The distinct independence of separated segments in many Cestodes, e.g. *Calliobothrium*, has no special bearing on the monozoic view, since analogous cases exist in other animals, e.g. Comatulidæ, *Autolytus*, and the "Palolo worm."

Distribution and Geological Age of Genus Oochoristica Lühe.†—F. Zschokke describes a new species of *O. rostellata* from *Zamenis viridiflavus*. The genus has an extremely wide geographical distribution, as well as very great variety in the matter of principal hosts. These facts bespeak a great geological age. In favour of this view is the fact that the South American hosts are exclusively ancient types; the parasites are not found in the animals which immigrated from North to South America at the Pliocene period, and they probably infested South American Mammalia in Tertiary times.

Trematodes of Bivalves.‡—W. Nicoll describes various parasites, viz. Cercariæ from *Cardium*, which do not occur in the same situation as those discovered by Jameson; an encysted Trematode larva from the mantle edge, the adult of which occurs in the oyster-catches (*Hæmatopus ostralegus*). It belongs to the sub-genus *Echinostomum*, and is probably a new species. The same parasite was found also in *Mytilus* and *Mactra*. Ciliated sporocysts were also found in *Cardium* in the liver and other situations, but no relation to the Cercariæ present in the same host has been made out.

Excretory System in Fresh-water Triclads.§—J. Wilhelmi has investigated and describes in detail the conditions of this system in five species. There are dorsally, right and left, two main stems, which branch greatly and again unite. Branchings over the whole dorsal region, as described by Chichkoff in *Dendrocœlum*, are not present in that species, nor are the transverse anastomoses which he described. In general the system resembles that of Cestodes and Trematodes in essentials, and

* Zeitschr. wiss. Zool., lxxxii. (1905) pp. 252–87.
† Op. cit., lxxxiii. (1905) pp. 53–67 (1 pl.).
‡ Ann. Nat. Hist., xcvii. (1906) pp. 148–55 (1 pl.).
§ Zeitschr. wiss. Zool. lxxx. (1906) pp. 544–75 (2 pls.).

differs in the mode of exit and the absence of cross anastomosis. The Rhabdocœles do not show the regularity of structure present in the excretory system of Triclads. The apparatus of the Polyclads is still less known. The fresh-water Triclads show most agreement with the marine *Gunda segmentata* as far as structure, course of the main stems, segmental arrangement of the "Knäuelbildungen" and dorsal openings. The segmental structure of the excretory system of the fresh-water Triclads is in favour of Lang's theory, which places *Gunda*-like Triclads as a link connecting Ctenophora and Hirudineæ.

Autogamy in Rhabdocœlids.*—Emil Sekera finds that self-fertilisation has a much greater role in these forms than is usually supposed. In Stenostomidæ (*Catenula*, *Stenostoma*) the testicular follicles burst within the body and liberate the spermatozoa, which reach the ovary. In *Macrostoma* the terminal copulatory organ can be bent round into the female genital aperture. A similar occurrence is noted for representatives of the Prorhynchidæ, e.g. *Prorhynchus stagnalis*, the Eumestomidæ, Vorticidæ, etc. By isolating individuals and observing their reproduction, the author seems, in short, to have shown that autogamy is general in fresh-water Rhabdocœlids.

Zoochlorellæ of Convoluta roscoffensis.†—F. Keeble and F. W. Gamble refer briefly to their experiments proving that the green cells of this Turbellarian result from infection from without. Samples of colourless *Convoluta* reared in sterilised surroundings were put into a vessel containing flagellate green organisms suspected to be the infecting organisms. In the course of two or three days the infected specimens of *Convoluta* showed in their tissues green cells identical in character with those of normal *Convoluta roscoffensis*. The green cells are true algæ, belonging to the Chlorophyceæ, and allied to *Chlamydomonas*; the presence of four equal flagella suggests that they belong to the genus *Carteria*.

Antarctic Rhabdocœlid.‡—A. Vayssière reports from Charcot's Antarctic collection a new Rhabdocœlid in the group Geoplanidæ, and with relations with *Rhodope*. The name *Rhodoplana* is, therefore, proposed.

Deep Sea Nemertines.§—F. F. Laidlaw gives a brief account of two Pelagonemertidæ, obtained by the Indian Marine Survey, which represent new genera. *Dinonemertes*, which is closely allied to *Planktonemertes*, is a broad, flattened, hyaline worm, with mouth and proboscis openings separate. *Bathynemertes* is a new genus whose position is somewhat obscure; it differs from all the other Pelagonemertidæ in the shape of the body, and when better known may require the formation of a special family for its reception.

* Zool. Anzeig., xxx. (1906) pp. 142-53.
† Proc. Roy. Soc., series B, lxxvii. (1906) No. B 514, pp. 66-8.
‡ Comptes Rendus, cxlii. (1906) pp. 718-19.
§ Ann. Nat. Hist., xcviii. (1906) pp. 185-8 (1 pl.).

Incertæ Sedis.

New Species of Cephalodiscus.* —E. Ray Lankester describes *C. nigrescens* sp. n., dredged by the 'Discovery,' in 100 fathoms, near Victoria Land, in the Antarctic Ocean. The colony is massive, the test nearly transparent, somewhat opalescent, and with a slight yellowish-brown tint. A beautiful photograph of a portion of the colony is given. The polypides are deeply pigmented and appear black to the naked eye. The pigmented cells are superficial, and are in reality brownish-yellow cells with one or two black spots of small size. This new species is clearly marked off from *C. dodecalophus* by the massiveness of the colony, the blackness and the large size of the polypides (three times as long as those of *C. dodecalophus*), and by the restriction of the polypides and their buds to separate tubes.

Reptant Eleid Polyzoa.†—W. D. Lang contributes some interesting facts regarding the family Eleidæ, which can only be enumerated here. He describes a means of determining by zoœcial characters the reptant "species" within the group, discusses the validity of the "genera" forming it, the occurrence in England of one of the "genera," *Semimultelea*, hitherto unrecorded from Britain, and considers the phenomenon of local groups of zoœcia having characters differing from those of the rest of the zoarium.

Old Age in Brachiopods.‡—H. W. Shimer summarises the principal characters which accompany old age in Brachiopods. Senility is first shown at the cardinal angles, and thence it spreads progressively to the anterior portion of the shell. Hence it is at the cardinal angles that we look for the first expressions of old age—as a change in the angle of curvature, lamellose growth lines, flattening of ribs, and development of a groove at the junction of the valves. When these characters do not appear simultaneously on the shell, they appear in a definite order—viz. (1) flattening of ribs; (2) lamellose development of concentric growth lines; (3) change in the angle of curvature; (4) formation of a groove at the junction of the valves; and (5) flattening of sinus and fold. Originating thus at the cardinal angles, these gerontic features are pushed farther and farther forward until in paragerontism they are present on the most anterior portion of the shell.

Rotifera.

Bdelloid Rotifera of the Forth Area.§—James Murray enumerates 53 species of Bdelloids obtained from moss gathered on hill-top and in peat-bog, on trees, walls, and rocks, by road-sides, and in streams, also a few from samples of *Lemna* and other pond weed, and some seaweeds. One new species, *Callidina microcephala*, is figured and described, as well as a variety of *Philodina brevipes*. The author's method of obtaining the

* Proc. Roy. Soc., series B, lxxvi. (1905) No. B 511, pp. 400–2 (1 pl.).
† Geol. Mag., No. 500 (1906) pp. 60–9 (12 figs.).
‡ Amer. Nat., xl. (1906) pp. 95–121 (30 figs.).
§ Proc. Roy. Phys. Soc. Edinburgh, xvi. (No. 5) pp. 215–229 (1 pl.).

Bdelloids and other moss-haunting Rotifers is worth repeating here. The moss is washed vigorously in a vessel of water; the water is then strained through a coarse silk net (No. 6 bolting silk), which retains all moss stems, leaves and larger debris, but allows all Rotifers to pass through. The water is then strained a second time, or condensed, through a silk net (No. 16 or 17) fine enough to retain all Rotifers. The condensed material should be examined as soon as possible, as many species do not live long under these altered conditions.

Rotifera of Kew Gardens.*—In a volume published by the Director, and giving an account of the Wild Fauna and Flora of the Royal Botanic Gardens, Kew, C. F. Rousselet enumerates 120 species of Rotifers which he has observed in the waters within this area. Some interesting forms were obtained, but no new species was discovered.

Marine Rotifera of Norway.†—O. I. Lie-Pettersen has studied the marine Rotifers of the Norwegian coast district near Bergen, including the fjords and brackish water pools on the islands, and enumerates 31 species, 9 of which, mostly Synchætæ, are Plankton Rotifers living in the open sea. The following 5 species are described as new: *Synchæta curvata*, *Notommata gravitata*, *Pleurotrocha bidentata*, *Diglena rousseleti*, *Mastigocerca marina*, which seems to be identical with *Diurella marina* of Daday. The drawings of the jaws are obviously incorrect, as they cannot possibly work, and the manubria are joined to the rami instead of to the unci.

Rotifera of Norfolk.‡—R. Freeman, having studied for one week in 1904, the Rotifers at the Norfolk Biological Station at Sutton Broad, gives a list of 120 species observed by him, with a few remarks on their occurrence, and on the method of collection and work.

Ciliated Infusorians within Eggs of Rotifer. § — H. Charlton Bastian describes the occurrence of a single large specimen of the ciliated Infusorian *Otostoma* inside the egg of *Hydatina*, and also the segmentation of the apparent contents of the egg into 12–20 spherical masses, which develop into young forms of *Vorticella* and *Oxytricha*. He believes that the egg-substance is actually transformed into the Infusorian or Infusorians—a case of heterogenesis—and he carefully notes the stages of the transformation. Those who are unable to accept Bastian's interpretation must offer some other—e.g. that Rotifers' eggs are liable to be parasitised.

Echinoderma.

Skin-Glands of Echinaster.‖—Ph. Bartels finds that the large skin-glands of *Echinaster sepositus* are wholly epithelial invaginations. Into the lumen of the simple gland cells are liberated from the periphery and burst, giving rise to mucus. The glands are surrounded by strong con-

* Kew Bulletin, add. ser., v. (1906) pp. 68–73.
† Bergens Museum Aarbog, x. (1905) pp. 3–44 (2 pls.).
‡ Trans Norfolk and Norwich Nat. Soc., viii (1905) pp. 138–47.
§ Proc. Roy. Soc., series B, lxxvi., No. B 511 (1905) pp. 385–92 (1 pl.).
‖ Zool. Anzeig., xxix. (1906) pp. 639–40.

nective-tissue fibres, but there are none in the interior. When the star-fish is irritated and contracts its skin, small drops ooze out, and it is likely that the secretion has some protective significance.

Modifications in Development of Sea-Urchins.*—Karl Peter has made experiments with the eggs of *Sphærechinus granularis*, in order to determine "individual variations in development." He finds that the gastrulæ, which were reared at a temperature higher than the normal, develop quickly, and show much greater deviations in the number of primary mesenchyme cells than those reared in cold sea-water.

Anatomy of Pentacrinus.†—A. Reichensperger gives an account of the antiambulacral nerve system, the "chambered organ" and cirrus vessels, the dorsal or glandular organ, and the gonads in *Pentacrinus decorus* Wy. Th. The chambered organ is formed of a thin layer of connective-tissue provided with a distinct endothelium. All its parts contain dark granules of doubtful nature. Its five chambers end blindly, it sends branches into the stem, and these are connected with cirrus vessels.

Cœlentera.

Medusæ from Amboina.‡—Otto Maas reports on a collection of 23 forms made by Bedot and Pictet. There are no new species, but the collection is of much interest as showing the very wide distribution of pelagic and littoral Medusæ.

Ontogeny and Interpretation of Siphonophore Colony.§—R. Woltereck gives some notes on Siphonophore development, and endeavours to explain the Siphonophore stock and its parts. The Chondrophoræ (*Velella*) in their simple plan of structure are remote from the Calycophoridæ; they consist only of the two chief zooids (planula-primary-polyp and terminal medusa) and of the products of the proliferation zone (blastostyle, with tertiary medusæ). These simplest Siphonophores show in their development a hint of relationship with the Narcomedusæ—viz. two rudimentary balancing tentacles of the primary zooid. The Siphonophore stock may be regarded as an individual in Huxley's sense (a chain of forms from egg to egg), which is differentiated into a great number of person-zooids and organ-zooids. Certainly the primary zooid (planula), which becomes the primary polyp, forms an aboral stolon, which is separated into terminal organ and circumpolar proliferation zone (stem). The Siphonophore stock may be derived from pelagic bipolar organisms ("Bipolaria" or primitive hydroid larvæ), whose aboral pole in the Narcomedusæ of to-day became a proliferating stolon, with a special terminal organ.

Digestion in Alcyonaria.‖—Edith M. Pratt discusses the structure and food of *Alcyonium*, *Sarcophytum*, *Lobophytum*, and *Sclerophytum*, and gives the results of her feeding experiments on *Alcyonium digitatum*,

* SB. k. Preuss Akad. wiss. Berlin, xl.–xli. (1905) pp. 884–9 (4 figs.).
† Bull. Mus. Comp. Zool. Harvard, xlvi. (1905) pp. 169–200 (3 pls.).
‡ Rév. Suisse Zool., xiv. (1906) pp. 80–107.
§ Zeitschr. wiss. Zool., lxxxii. (1905) pp. 611–37 (21 figs.).
‖ Quart. Journ. Micr. Sci., xlix. (1905) pp. 327–62 (3 pls.).

confirmed on *Corallium rubrum*. Solid particles of carmine are ingested by the endoderm cells of the mesenterial filaments, body-wall, and endodermal canals. The endoderm cells of the ventral mesenterial filaments, the body-wall, the canals, and cords in the mesoglœa, are frequently amœboid. The presence of ingested carmine particles in the cells of the mesoglœal plexus indicates that they have been conveyed from the cœlenteric cavities of the zooids to portions of the colony apart, or even remote, from the zooid. The cells of the so-called "mesoglœal nerve plexus" are amœboid, and the so-called "nerve-fibres" are their pseudopodia. The mesoglœal plexus is more intimately connected with the endodermal than with the peripheral ectoderm tissues, and the so-called "nerve-cells and fibres" are immigrant endoderm cells, forming a nutritive as well as a sensitive plexus. Another interesting point is that a reduction of the digestive surface in tropical forms is associated with a corresponding increase in the number of zoochlorellæ.

Monograph on Primnoidæ.*—J. Versluys has done a notable piece of work in his memoir on the Primnoids of the Siboga Expedition. He has not only described numerous new and interesting species, but he has put our knowledge of the whole family on a more secure basis. His discussion of the architecture of the polyps is accompanied by a series of exceptionally fine text-figures, and the phylogenetic discussion is also very valuable. There is a suggestive chapter on geographical distribution.

Sclerites and Canals of Primnoids.†—F. Menneking has studied *Stachyodes ambigua* Studer, *Caligorgia flabellum* Ehrb., *Calyptrophora agassizii* Studer, *Amphilaphis abietina* Studer, and *Thouarella variabilis* Studer. In these he finds a canal-system of eight main canals and numerous accessory canals, except in the species of *Amphilaphis*, which has, apart from accessory canals, only four main canals. All the five species have a more or less strongly marked siphonoglyph on the dorsal surface of the polyp. The end of the partitions between the eight main canals shows a triangular thickening, perhaps a vestige of a mesenteric filament. The partitions are derived from mesenteric folds. All the species had ova in the canals. The analogy between the internal structure of *Amphilaphis abietina* and that of Pennatulids is commented on.

Axis of Alcyonarians.‡—Th. Studer contrasts the view of von Koch and others that the axis is a simple excretion of the ectoderm, with the view of Lacaze-Duthiers, and Kölliker (to which he has previously expressed his adherence), that the axial skeleton is formed either by the mesoglœa, or by formed elements which penetrate from the ectoderm into the gelatinous mass of the intermediary substance. In Scleraxonia the axis is due to spicules, which have their origin in the mesoglœa; in *Alcyonium palmatum* the mesoglæa gives rise to horny substances; in *Eunicella graminea* the spicules have an important role in making the axis, forming centres around which the horny substance is deposited. They are subsequently absorbed. From a study of *Telesto* and *Cœlogorgia*, Studer has been led to the theory that in other cases (Gorgonaceæ)

* Siboga-Expeditie, Monographie xiii*a*. (Leiden, 1906) pp. 187 (10 pls., 178 figs., 1 map.)
† Arch. Natur. Ges., lxxi. (1905) pp. 245–66 (2 pls.).
‡ Arch. Sci. Phys. Nat., xx. (1905) pp. 581–4.

there may be a similar mode of origin—that the axis is formed independently inside each *axial* polyp, filling up most of its gastral cavity, and only uniting secondarily with the ordinary lateral polyps.

Porifera.

New Silicious Sponges.* — L. Baer describes collections from Zanzibar, Cape Town, and Tahiti, twenty species in all. Fifteen of these are new, and of *Tedania digitata* Schmidt three varieties are established, mainly on account of their external form and the characters of the canal system.

Californian Sponges.†—F. Urban describes very fully four new species of calcareous sponges from Monterey Bay, California, of the genera *Leucosolenia*, *Sycandra*, and *Leucandra*. Particular attention has been given to the dimensions and angles of the spicules of the various regions.

Protozoa.

Structure of Cytoplasm in Protozoa.‡ — E. Fauré-Fremiet distinguishes the cytoplasm proper (including hyaloplasm and paraplasm) from enclosed "spheroplasts," which do not represent the intimate structure of the protoplasm (as Kunstler thinks), but are elements comparable to the leucites of plants. They have a certain individuality; they multiply by division; they can elaborate products necessary to life.

Amœboid Movements.§ — L. Rhumbler defends his mechanical theory of surface-tension movement in *Amœba*, and points out that it is not dependent on the movements termed "Fontänen-strömung," whose existence Jennings calls in question. These movements, though not frequent, certainly do occur in some *Amœbæ*; it is not their unconditional necessity, but their theoretical value as a starting point, which accounts for their occupying the chief place in the author's theories. It is not claimed that there is more than a parallel value or "convergence" shown in the comparative experiments with organic and inorganic mechanics; the chemistry in both is fundamentally different. It is possible that in the *Amœba* resides a "Miniaturpsyche"—an energy of unknown character, and not necessarily metaphysical because absent in the inorganic. Jennings' latest observations do not bear upon the author's interpretations in this respect.

Life-History of Hypotrichous Infusoria.‖—Lorande Loss Woodruff has made an interesting experimental study on species of *Oxytricha*, *Pleurotricha*, and *Gastrostyla*, with the main object of ascertaining if the life-history is characterised by "cycles," and if so, how these are marked by cytological changes and related to environmental influences.

All the cultures furnished evidence that the species pass through periods of greater and less vitality as measured by rate of division.

* Arch. Natur. Ges., lxxii. (1906) pp. 1–32 (5 pls.).
† Tom. cit., pp. 33–76 (4 pls.).
‡ Comptes Rendus, cxlii. (1906) pp. 58–60.
§ Zeitschr. wiss. Zool., lxxxiii. (1905) pp. 1–52 (23 figs.).
‖ Journ. Expér. Zool., ii. (1905) pp. 585–632 (3 pls.).

The periods of depression lead to death of the culture if subjected continuously to the same environment.

A cycle is a periodic rise and fall of the fission-rate, extending over a varying number of "rhythms," and ending in the extinction of the race unless it is "rejuvenated" by conjugation or by changed environment. A "rhythm" is a minor periodic rise and fall of the fission-rate, due to some unknown factor in cell-metabolism, from which recovery is autonomous.

Changes in environment, e.g. treatment with extract of beef, will revive the lagging functions during the descending cycle. Seasonal and temperature changes have no apparent influence on the cyclical fluctuations of vitality. Variation in temperature, however, undoubtedly affects somewhat the daily rate of division—if not directly, at least through the food supply. The number of generations in a cycle is not at all constant, and duration in time seems of no significance.

Periods of depression are marked by the greatly decreased fission-rate, comparatively frequent pathological divisions, increased vacuolisation of the cytoplasm, distortion and fragmentation of the macronuclei, numerical increase of the micronuclei, and reduction of the ciliary apparatus. The organisms are small during periods of high reproductive activity, and increase in size as "degeneration" advances. Just before extinction there is a secondary reduction in size. Throughout the entire period of the cultures no tendency to conjugate was seen. Experiments showing extreme sensitiveness to solutions of salts are recorded; the results differ at various periods in the life-cycle. Light has little or no direct effect on the division-rate of *Oxytricha fallax*.

Conjugation in Infusoria.*—J. Versluys shows how partial karyogamy or conjugation may be deduced from total karyogamy or copulation, and considers that the former has gradually arisen from the latter, mainly as a result of the increasing complication in the structure of the Infusoria, and perhaps favoured also by the great independence of the specialised sex nuclei. The relation between the two types is clearly set forth in diagrammatic form. It is also pointed out that partial karyogamy is limited in distribution, though less so than Lang has supposed, which is against the view that it is primitive.

Trophoplasmic Spherules in Ciliata.†—J. Kunstler and Ch. Gineste describe under this title vesicular elements in the endoplasm of *Opalina*, etc., which sometimes show a central nodule or internal granules, and which multiply by fission, preceded by the division of the internal nodule.

New Peridinid.‡—C. A. Kofoid describes from the plankton of the Pacific at San Diego Station representatives of *Heterodinium*, a new genus of Peridinidæ, differing entirely from *Peridinium* as regards its thecal plates. It belongs, with *Ceratium*, *Peridinium*, and *Protoceratium*, to the sub-family Ceratiinæ, and is divisible into three sub-genera—*Sphærodinium*, *Euheterodinium*, and *Platydinium*.

* Biol. Centralbl., xxvi. (1906) pp. 46–62 (2 figs.).
† Comptes Rendus, cxli. (1905) pp. 907–8.
‡ Univ. California Publications (Zoology) ii. No. 8 (1906) pp. 341–68 (3 pls.).

Structure of Gonyaulax triacantha.*—C. A. Kofoid describes the thecal structure of this imperfectly known Peridinid. Its occurrence in Alaskan waters, and the previous records of its appearance in the plankton off the coasts of Norway, Iceland, Shetland, and Finland, indicate that it is a boreal neritic species of wide distribution.

Flagellates in Human Alimentary Canal.†—A. Rosenfeld reports the presence of *Trichomonas intestinalis* in the weakly-alkaline fluid of the stomach of four advanced cases of stomach cancer, in the gastric juice of a non-cancerous person, and also amongst the contents of carious teeth. Their presence in the intestine does not appear to have pathological significance.

Flagellata in Melophagus ovinus.‡—C. Pfeiffer records and demonstrates the occurrence of various developmental stages of trypanosome-like parasites in the gut of *Melophagus ovinus* from the sheep. The female appears to be more markedly infected than the male, and in the former, moreover, observation of the living parasites is easier. The flagellates belong to the genus *Herpetomonas*.

Distinctions between Species of Trypanosoma.§—R. Koch discusses the difficulty of establishing secure distinctions between the different species of Trypanosome. Already the number of described forms is rapidly mounting up, and it is much to be desired that the specific characters should be well defined. Besides *T. brucei* (tsetse disease), *T. evansi* (Surra), *T. equiperdum* (Dourine), *T. equinum* (mal de Caderas), *T. gambiense* (sleeping sickness), other forms are now engaging attention, and it is uncertain how far all the named species are distinct. A new species should not be established unless the essential features of the life-history are known. Koch discusses in particular the relations of *T. brucei* and *T. gambiense*. In the former there is a small roundish blepharoplast, 1 μ in diameter; in the latter there is a strikingly large blepharoplast, 1·5 μ in breadth and 2·5 μ in length, which lies transversely to the long axis of the cell. The following measurements may be useful :—

	Length.	Breadth.
T. brucei, female . .	25·0 μ	3·6 μ
T. gambiense, female . .	37·0 „	3·0 „
T. brucei, male . . .	40·2 „	2·1 „
T. gambiense, male . .	34·0 „	0·85 „

Ceylonese Hæmatozoa.‖—Aldo Castellani and Arthur F. Willey discuss (1) some free, unpigmented Gregariniform bodies observed in the blood of man and birds; (2) pigmented endoglobular parasites of a Gecko, which they refer to a new genus of Hæmamœbidæ (*Hæmocystidium simondi*); (3) a Hæmogregarine (*Hæmogregarina nicoriæ* sp. n.)

* Zool. Anzeig., xxx. (1906) pp. 102–5 (1 fig.).
† Deutsch. med. Wochenschr., xlvii. (1904). See also Centralbl. Bakt. Parasit., xxxvii. (1906) p. 611.
‡ Zeitschr. Hyg. Infect., l. (1905) p. 324. See also Centralbl. Bakt. Parasit., xxxvii. (1906) pp. 611–12.
§ SB. k. Preuss. Akad. wiss. Berlin, xlv.-xlviii. (1905) pp. 958–62.
‖ Quart. Journ. Micr. Sci., xlix. (1905) pp. 383–402 (1 pl.).

from an amphibious tortoise, *Nicoria trijuga*; (4) a related form from *Tropidonotus piscator*. They also make some notes on Trypanosomes and Filariæ.

Hæmatozoa from Partridge and Turkey.*—A. Laveran and Lucet describe from the Hungarian partridge (*Perdix cinerea*) a parasite which seems to be *Hæmamœba relicta*, known to pass part of its life-history in the mosquito. In the white blood corpuscles of turkeys (which died of peritytphlo-hepatitis) they found a new species which they name *Hæmamœba smithi*.

Babesia.†—Max Lühe discusses this blood-parasite (= *Piroplasma* Patton, 1895) which occurs in two forms—a pear-shaped form within, and an amœboid form on the surface of the erythrocytes. It is probable that the former are gametocytes, the latter asexual stages.

Affinities of Haplosporidia.‡—M. Caullery and Félix Mesnil give the results of researches upon the families Haplosporidiidæ, Bertramiidæ, Cœlosporidiidæ, and other forms of both doubtful and certain affinity with the Haplosporidia. They conclude that the families reviewed should be classed in a special order of the Neosporidia. In the general simplicity of their development and the simple structure of their spores there is some ground for placing them at the base of the Sporozoa, at least of the Sporozoa endosporea. They show affinity with the Plasmodiophoreæ.

Hæmosporidia of Bats.§—A. Schingareff has endeavoured, without much success, to throw light upon the life-history of the three known species of *Hæmosporidia* in bats. Experiments with mosquitos were unsuccessful in producing infection, and it is thought that the carrier may be *Nycteribia*, an insect which feeds on the blood of the bats. Nothing, however, in any way resembling sporocysts, such as are found in infected mosquitos, were found in sections of the gut of *Nycteribia*, and the question of infection thus remains open.

Life-History of Pleistophora periplanetæ, Lutz and Splendore.‖—W. S. Perrin gives an outline of the life-history of this Myxosporidian, which infests the Malphigian tubules and intestine of *Periplaneta orientalis*. There are two very definite phases: a trophic, characterised by an almost excessive multiplication leading to auto-infection, and a propagative phase, characterised by a cessation of trophic activity and the formation of resting spores. In these features it resembles *Thelohania mülleri*, and by no means agrees with Schaudinn's grouping of the Sporozoa into Telosporidia and Neosporidia in terms of the period at which sporulation occurs. This grouping is probably well-grounded, but must be expressed in other terms. Another point of interest in this life-history is afforded by the existence of residuary nuclei and protoplasm, which die off while sporulation is taking place. A fuller paper

* Comptes Rendus, cxli. (1905) pp. 673–6.
† Zool. Anzeig., xxx. (1906) pp. 45–52.
‡ Arch. Zool. Expér., iv. (1905) pp. 101–81 (3 pls.).
§ Mikrobiol. Ges. St. Petersburg, 1905. See also Centralbl. Bakt. Parasit., xxxviii. (1906) pp. 12–13.
‖ Proc. Cambridge Phil. Soc., xiii. (1906) pp. 204–8.

is promised, discussing the meaning and homologies of these features. A note is added upon another parasite of *Periplaneta*, which is probably an undescribed Myxosporidian.

Wall of Myxosporidian Spores.*—L. Léger and E. Hesse find that the sporal wall is not a simple secretory product, but is always formed from two parietal cells, each of which forms one of the valves of the spore.

New Microsporidian from Loach.†—Casimir Cépède describes a rare cryptocystic Microsporidian—*Pleistophora macrospora* sp. n.—found once in *Cobitis barbatula* in Dauphiny.

Reproduction of Monocystid Gregarines.‡—L. Brasil describes the changes which occur in the cyst of the species of *Monocystis* found in the earthworm, and which lead to the formation of gametes. Three kinds of mitosis appear to occur. What is perhaps more important, there is a dimorphism of gametes produced from one cyst. The two Gregarines which become apposed in conjugation, do not give rise to absolutely similar gametes. There is a conjugation of the larger and smaller gametes—a hitherto overlooked, slight, but real anisogamy.

Eleutheroschizon duboscqi, a new Sporozoon.§—L. Brasil describes this new parasite, from the intestine of *Scoloplos armiger* at Luc sur Mer. It occurs attached to the epithelium usually, but is sometimes free in the gut. It is a relatively rare parasite, occurring in August and September in one individual in twenty. The infected Annelids usually contain many parasites: there are often nearly 100 in a section 10 μ in thickness. The parasite is dome-shaped, 30 μ long, and carries a sharp point, which is sometimes bent like a hook, upon the convexity. The base bears a double set of lobes which penetrate into the epithelium. There appears to be a long series of schizogonic multiplications; the merozoites are small and claviform. In its extra-cellular schizogony, and extra-cellular growth of merozoites, and in the *pari passu* increase in the number of nuclei, and the dimensions of the schizont, this new form approaches the Schizogregarines, but nothing is yet known of the conjugating stage.

* Comptes Rendus, cxlii. (1906) pp. 720–2 (8 figs.).
† Tom. cit., pp. 56–8.
‡ Arch. Zool. Expér., iv. (1905) pp. 69–99 (2 pls.).
§ Arch. Zool. Expér., iv. (1906) Notes et Revue, pp. xvii.–xxii. (5 figs.).

BOTANY.

GENERAL,

Including the Anatomy and Physiology of Seed Plants.

Cytology,

including Cell Contents.

Micro-chemistry.*—O. Richter gives a very useful account of the advances in botanical micro-chemistry since the appearance of Zimmermann's 'Botanischer Mikrotechnik,' in 1892. There is also a useful list of new vegetable substances which have been described of late years, with the name of their discoverer, and a description of their nature.

Protoplasmic Continuity.†—T. Wulff has studied protoplasmic continuity in Monocotyledons, and has demonstrated the existence of "plasmodesmen" between the mesophyll cells and the mesophyll and epidermal cells of the leaf of various cereals; and between the endosperm cells and the cells of the aleurone layer in the seed of oats.

Sexuality of Ascomycetes.‡—Although the presence of a normal sexual fusion of nuclei—in addition to the ascus fusion—is now indisputably proved for a number of Ascomycetes, yet normal sexuality is clearly not present in all cases. A number of forms have been known for some time in which there is no antheridium, but the development is otherwise normal. V. H. Blackman and H. C. Fraser have for the first time investigated one of these forms cytologically. In *Humaria granulata*, a coprophilous member of the Discomycetes, the ascogonium, which is a multi-nucleate "cœnogamete," like that of *Pyronema*, is borne on the end of a short branch. The ascogonium develops normal ascogenous hyphæ, but there is no antheridium, and, therefore, no cell fusion. The fusion between male and female nuclei is, however, replaced by a fusion in pairs of the female nuclei of the ascogonium. This type of fusion must obviously be considered as a "reduced fertilisation" comparable to that found in the æcidium of the Uredineæ; the male cells in both cases having either disappeared or become abortive. The authors suggest that this type of fertilisation will probably be found to be more common in the Ascomycetes than the normal sexual fusion.

Sexuality of Uredineæ.§—V. H. Blackman and H. C. Fraser have continued the observations of the first named author. They show that nuclear migrations are to be found in connection with the basal cells of the æcidium in *Uromyces Poæ* and *Puccinia Poarum*; while in *Melampsora Rostrupi* the fertile (female) cells of the æcidium fuse in

* Zeitschr. Wiss. Mikrosk. xxii. (1905) pp. 194–261.
† Arkiv Bot., v. (1905) No. 2, pp. 1–20 (1 pl.).
‡ Proc. Roy. Soc., Series B, lxxvii. (1906) pp. 354–68, pls. 13–15.
§ Ann. of Bot., xx. (1906) pp. 35–48, pls. 3, 4.

pairs as first described by Christman. While in *U. Poæ* nuclear migration seems to take place only into the fertile cells, in *P. Poarum* a small number of migrations appear to take place between vegetative hyphæ below the layer of fertile cells. The conjugate nuclear condition is thus started before the differentiation of the cells which represent the female cells. This condition leads on to that found in *P. Malvacearum*, where no æcidium is produced, and the conjugate nuclear condition arises in the vegetative hyphæ just before the formation of teleutospores. In *Uromyces Scillarum* and *Puccinia Adoxæ* there is a further stage of reduction—where the conjugate nuclear condition arises at some unascertained stage, but very early in the life-cycle, so that the general mycelium is binucleate.

Nuclear Division in Hepaticæ.*—J. B. Farmer and A. C. Moore continue their controversy about sporogenesis in *Pallavicinia*, and about the significance attached to the quadripolar spindle by the former writer ten years ago.

MERRIMAN, MABEL L.—**Nuclear Division in Zygnema.**
Bot. Gazette, xli. (1906) pp. 43–53 (2 pls.).

Structure and Development.

Vegetative.

Mechanism of the Fall of certain Terminal Buds.†—A. Tison has investigated the mechanism of the fall of certain terminal buds, and finds it exactly similar to that of the autumnal leaf-fall. Most frequently only the terminal bud falls, as in *Ulmus campestris*, *Betula alba*, etc., but sometimes several terminal internodes also fall, as in *Robinia Pseud-acacia*, etc. Prior to the full development of the subtending leaf, a separating layer is formed just above it, and discoloration, extending upwards from this line, is the first sign of the bud's decay. When leaves or leaflets are involved in the fall, each one has its own separating layer. These layers are formed during the plant's maximum period of growth; their action is slower than that of the layers connected with leaf-fall, since the latter is aided by the weight of the leaf and by frost and thaw. The bud, even when detached, may be held in position by stipules, as in *Betula alba*. The fall usually takes place in June. The wound caused by the fall is closed in the same way as in leaf-fall. Generally the axillary bud continues the growth of the branch, but in some cases, e.g. *Morus alba*, this bud dries up (without the formation of a separating layer), and then the one next below continues the growth. The cambium of the growing bud then extends across the base of the fallen bud, thus closing up the central cylinder.

Reproductive.

Anatomy of the Flower of the Umbelliferæ.‡—E. Martel, as a result of the study of the flower, especially as regards the course of the vas-

* Bot. Gazette, xli. (1906) pp. 67–70.
† Comptes Rendus, cxlii. (1906) pp. 222–4.
‡ Mem. R. Accad. Sci. Torino, ser. 2, lv. (1905) pp. 271–83 (1 pl.).

cular bundles, in *Smyrnium*, *Pastinaca*, *Astrantia*, *Heracleum*, and other genera, comes to the conclusion that the gynœcium, although consisting only of two carpels, represents theoretically two complete whorls, and the ovary proper is represented by the stylopod and not by the cavity beneath. The commissural bundle is formed by the union of four placental bundles, and at maturity forms the podocarp. The separation of the ripe carpels is determined by the lignification of the commissural bundle, the drying and separation of the parenchyma forming the median diaphragm, and by the breaking of the lateral vascular bundles at the base of the fruit.

Anatomy of Seeds of Acanthaceæ.*—E. Schaffnit has studied the structure of the seeds of Acanthaceæ in a large and representative number of genera and species. The seeds are almost always more or less flattened, and curved inwards at the organic base. Exceptions to this are those of *Thunbergia*, hemispherical and hollowed out on the inner face, where they are inserted upon a cupular expansion of the placenta; also those of *Elytraria* (*Tubiflora*), which are almost spheroidal. The size varies much; of those measured by the author the largest, *Acanthus*, has a length of 10–12 mm., the smallest, *Hygrophila*, measuring only 0·5–3·2 mm. The surface is smooth or provided with ridges, scales, or warty excrescences, or with longer or shorter hairs. Endosperm is present, but usually in such small quantities that the seeds pass with systematists as "exalbuminous." Although the systematist errs technically here, his statement is physiologically correct, since the reserve materials stored in this rudimentary endosperm would seem not to be made use of in germination. In both endosperm and embryo the carbohydrate constituent is not starch, but fatty oil, except in the case of *Acanthus*, where starch is found.

The author has examined a number of seeds of examples from all the five recognised tribes of the order. Four types of surface are distinguished:—(1) Surface occupied entirely or partially by slime-hairs or slime-cells. (2) Surface occupied entirely or partially by hairs not becoming slimy on contact with water. (3) Surface uneven owing to the presence of groups of epidermal cells which project beyond their fellows. (4) Surface occupied by cells of uniform height, and consequently smooth.

A full account follows of each seed examined. Except for typical cases which are dwelt on in detail, the method is that of the systematist marshalling the data for his description. The size of the seed, the clothing of its epidermis if any, the nature and contents of the tissues of the testa and then those of the endosperm are succinctly dwelt with, and, finally, the contents of the cells of the embryo. Except in the case of *Acanthus*, where starch is the reserve carbohydrate, the cells of the embryo were found to contain polyhedral aleurone grains and fatty oil, to which were often added crystals of calcium oxalate, and rarely tannin.

Nutrition of Plants in absence of Carbon dioxide.†—M. Molliard has investigated the structure of plants grown in light without CO_2 and

* Beih. Bot. Centralbl., xix., Sect. 1 (1906) pp. 453–521 (18 figs. in text).
† Comptes Rendus, cxlii. (1906) pp. 49–52.

in presence of organic matter. Two radish plants were grown in a culture solution containing 10 p.c. saccharose. One remained in contact with air, and at the end of 121 days had started to form fruits. The other remained under the same conditions for 70 days, and was then inclosed in air free of CO_2 for 41 days. The leaves were small and the flowers still unopened. The cortex was thick, but lacked the normal sclerenchyma, while some of its cells were multinucleate. There was much secondary wood, but the vessels were small and feebly thickened. Starch was very abundant, being found even in the epidermis. The leaves were thin and had few air-spaces, the mesophyll being closely packed and full of starch. Similar results were obtained with a solution containing 5 p.c. glucose and 2 p.c. asparagin.

In short, it seems that plants deprived of CO_2 can make more use of organic substances than when under normal conditions; also, the differences observed are very much like those found between subterranean organs and homologous aerial organs.

Symbiosis of Orchids and Fungi.*—Noel Bernard, in his work on the endophytes of *Cattleya*, *Phalænopsis*, and *Odontoglossum*, finds that each species prefers its own endophyte; but he has sometimes succeeded in causing the embryos of a certain species to enter into combination with each of two different fungi. Experiments were made with hybrid seeds of *Lælia Mozart*, *Brassavola Digbyana*, and with pure seeds of *Vanda tricolor*, using the endophytes of *Cattleya*, *Phalænopsis*, and *Odontoglossum*. *Lælia Mozart* and *Brassavola Digbyana* gave good results with the endophyte of *Cattleya*, on a jelly substratum; but with the endophyte of *Phalænopsis*, on a substratum of cotton, the tubercle was larger and absorbing hairs more numerous. *Vanda tricolor*, cultivated with the endophyte of *Phalænopsis* on a substratum of elder pith, attained full development of the tubercle, and had produced three leaves and a root in three months. With *Odontoglossum* the period of tuberisation was much prolonged, and there were no leaves at the end of five months. It would appear that successful results depend on the nature of the substratum and on the time of infection. The rapidity and mode of growth depend on the nature of the endophyte.

General.

Irish Topographical Botany.†—R. Ll. Praeger gives a supplement to his "Irish Topographical Botany," published in 1901, which embodies the results of the work of the last five seasons. The net total number of species and sub-species to be added to the county lists is 814. Twenty-four plants have been added to the Irish list as a whole. These are mostly critical forms, and include seven Brambles and six Hawkweeds; three are not yet recorded elsewhere. A new fumitory, *Fumaria purpurea*, has been detected both in Great Britain and Ireland, and *Glyceria festucæformis*, a Mediterranean grass, as yet unknown in Great Britain, has been found at several places in County Down.

* Comptes Rendus, cxlii. (1906) pp. 52–4.
† Proc. Roy. Irish Acad., xxvi., sect. B (1906) pp. 13–45.

Yucatan Plants.* — The continuation (fasc. 2) of the flora of the Yucatan peninsula comprises an account of the Compositæ by C. F. Millspaugh and Agnes Chase. An important feature is the illustration of every species by cuts showing the form of the flower-head and details of the fruit. There are also a number of full-page plates.

FRIES, R. E.—**Zur Kenntnis der Alpinen Flora im Nördlichen Argentinien.**
[An ecologic and systematic account of a botanical exploration of the mountains of north-west Argentina under the auspices of the Swedish Chaco Cordillera Expedition, 1901–2.]
Nova Acta R. Soc. Sci. Upsal, ser. 4, i. (1905) pp. 1–205 (1 map, 9 pls.).

SELIBER, G.—**Variationen von Jussieua repens.**
[An account of the variations in general form and internal structure when the plant is grown under different conditions as regards moisture, light, and warmth.] *Nova Acta Acad. Caes. Leop.-Carol. German. Nat. Cur.*, lxxxiv. (1905) pp. 147–98 (3 pls.).

VIERHAPPER, F.—**Monographie der alpinen Erigeron-Arten Europas und Vorderasiens.**
[An exhaustive morphological and systematic account of the Alpine species of *Erigeron*, with details of their distribution in Europe and Asia Minor.]
Bot. Centralbl., xix., sect. 2 (1906) pp. 385–560 (6 pls., 2 maps).

CRYPTOGAMS.

Pteridophyta.

(By A. Gepp, M.A., F.L.S.)

Anatomy of Ferns.†—F. Pelourde has made a comparative study of the root and petiole of certain fern genera, and presents his results in a short note. He comes to the following conclusions: The genera *Asplenium*, *Polypodium*, and *Adiantum* are homogeneous. The former presents great affinity with *Scolopendrium* and *Ceterach*, and is easily distinguished from *Athyrium*, as is also *Polypodium* from *Phegopteris*. *Nephrodium* is heterogeneous, and the author considers this genus should be rearranged to include *Aspidium angulare*. Finally, *Pteridium* is quite different from the true species of *Pteris*.

Regeneration of the Lamina in Scolopendrium.‡ —W. Figdor describes the experiments he has made on the lamina of *Scolopendrium vulgare* Sm. to bring about instances of regeneration. His first attempts were unsuccessful; but when he cut a fraction of a millimetre in length along the middle of the rolled up growing point of a frond, and left it for two to three months, he found that a division had taken place in the tissue of the growing point, and the costa had divided. Between the two branches assimilative tissue had developed. Nowhere was there any sign of healing periderm. The growth which follows a splitting of the growing point of different ages is described, and the author points out that systematists have described as var. *dædalea* Döll. just such a plant as he has produced artificially. He suggests that the

* Field Columbian Museum, Bot. series, iii. No. 2 (1904) pp. 85–154, profusely illustrated.
† Comptes Rendus. cxlii. (1906) pp. 642–5.
‡ Ber. Deutsch. Bot. Gesell., xxiv. (1906) pp. 13–16 (1 pl.).

splitting may be the work of small animals, which wound the growing point of young plants. This division of the lamina occurs more commonly in England than in Austria.

Sporangial Trichomes.*—E. J. Durand writes a note on trichomic outgrowths which occur on the sporangia of certain ferns, arising from the lateral walls near the annulus. He found them first on the sporangia of *Dryopteris thelypteris*, and was thus led to examine herbarium specimens representing about 200 species, both native and exotic. Of these 15 were found to possess sporangial trichomes, and the names of these species are given. Sporangial trichomes occur only in such ferns as have similar trichomes on the surface of the frond. It is suggested that the sporangial trichomes may be protective, since they exist most commonly in non-indusiate species. The author notes also that he has seen a branch arising from the stalk of a developing sporangium in *Pteris cretica*, which appeared in all respects similar to that figured for *Dryopteris filix-mas* in the text-books.

Allantodia.†—M. Raciborski has studied the genus *Allantodia*, having collected material in Java. Sections of the young sporophylls show that the indusium is not, as Christ and Diels state, attached all round, but on one side only, and, arching right over the sorus and bending inwards, protects the sporangia from below also. The author, having compared the spores with those of other Asplenioid genera, finds their structure to be of value only as specific, and not as generic, characters. With reference to the spines and hooks on certain spores, these occur especially in species which inhabit the precipitous walls and dripping rocks of mountain gorges. According to individual views, *Allantodia* either falls into a comprehensive *Asplenium*, or at least into *Athyrium*, but if this latter also be broken up, then *Allantodia* takes generic rank, having *Hemidictyon* as a synonym.

Botrychium.‡—G. E. Davenport maintains the identity of American and European plants of *Botrychium matricariæfolium* A. Br., giving photographs of a number of specimens to confirm his argument. In a similar way he shows *B. neglectum* Wood to be identical with *B. matricariæfolium* var. *subintegrum* Milde. Next as to *B. ramosum*, which Ascherson founded on *Osmunda ramosa* Roth., and which is generally considered to be synonymous with *B. matricariæfolium*, Davenport shows by abundant citations from old literature, that *B. ramosum* Asch. does not equal *Osmunda ramosa* Roth., for this latter is clearly a synonym of *Botrychium Lunaria*. Finally, Davenport traces out the early history of *B. matricariæfolium* from pre-Linnean times. C. A. Weatherby§ describes an extreme form of *Botrychium virginianum* found in Connecticut; it is 2 ft. 3 in. high, and bears three fertile spikes.

Cheilanthes Szovitsii.‖—R. Pampanini discusses the history, distribution, and presence in Italy of this species. It was first found on

* Fern Bull., xiv. (1906) pp. 20–1.
† Rozp. Akad. Umiej. Krakowie, v. (1905) pp. 166–72.
‡ Fern Bulletin, xiv. (1906) pp. 11–19 (2 pls.).
§ Rhodora, viii. (1906) pp. 47–8.
‖ Nuov. Giorn. Bot. Ital., xiii. (1906) pp. 139–57.

the mountains between Halamdart and Marinte, in Irak-Adjem by Bélanger, and described by Bory as *Notholæna persica*. Since then it has been found in Transcaucasia, Dalmatia, and Italy, and more recently in the Himalayas, Asia Minor, Greece, and Algeria. *C. Szovitsii* is the only species of the section *Physapteris* which occurs in the old world, the other four species being confined to the Andes, the United States, and Chili. The author then discusses the presence of the plant in the two recorded Italian localities, Monte Mauro and Monte Baldo. The latter must, in his opinion, be excluded from the area of this fern's distribution; and the reasons for this opinion are fully stated. On Monte Mauro, near Faenza, it has been found by the author himself as well as by two others previously, and the origin of this isolated habitat is discussed, the author considering that the plant has emigrated to Italy from Dalmatia, the spores being carried by the wind.

Genus Stenochlæna.*—L. M. Underwood has made a careful study of this genus. He divides it into four sections: *Eustenochlæna*, *Cafraria*, *Teratophyllum*, and *Lomariopsis*. The species of the first three sections are all confined to the tropics of the Old World. Those of the section *Lomariopsis* are divided between the tropics of the Old and New Worlds, approximately in the ratio of 3 to 2. Keys to the species are given, and to each species is appended a list of synonymy with references to literature, a list of published figures, and the geographical distribution. Three new species are described, and several species hitherto included in other genera, are now transferred to *Stenochlæna*. There are ten figures of pinnæ, natural size.

Lycopodium in the American Tropics.†—L. M. Underwood and F. E. Lloyd publish an account of the species of this genus from the West Indies, the Santa Marta region of Columbia, the Andean region of Bolivia and Mexico; occasional species from S. America are also included. The list does not profess to be exhaustive, as many regions need still further exploration. The authors treat the genus under the three sections, *Selago*, *Lepidotis*, and *Diphasium*. Keys are given to the species included in each section and subsection, and each species is then treated separately, critical notes, range, and quotation of specimens in herbaria being given. Seventeen new species are described.

Chinese Ferns.—H. Christ ‡ publishes an account of the ferns collected in Western China (1903–4) by E. H. Wilson for Veitch & Sons. The collection was made in the western part of Sze Tchuen, many specimens coming from Mt. Omei, which was visited by Faber in 1887. Of the 160 forms enumerated 21 species and 11 varieties are new, 74 are endemic, and 60 others are essentially Chinese but have spread westwards along the southern slope of the Himalayas, and were first recorded from that region. The author insists upon the great influence exercised by huge mountain ranges upon the migration of plants by means of the controlling agents—wind and rain. H. Leveillé § records

* Bull. Torrey Bot. Club, xxxiii. (1906) pp. 35–50 (10 figs. in text).
† Tom. cit., pp. 101–24.
‡ Bull. Acad. Internat. Géogr. Bot., xv. (1906) pp. 97–142 (1 pl.).
§ Tom. cit., p. 58.

the occurrence of *Azolla caroliniana* in China. It was found abundantly in rice-fields and swamps at Hongkong by Boudinier.

Ferns and Fern-allies of Costa Rica.*—H. Christ continues and concludes his work on this subject, and treats of the following genera: *Asplenium*, *Lomaria*, *Cyathea*, *Alsophila*, *Dicksonia*, *Cibotium*, *Pteris*, *Hypolepis*, *Lonchitis*, *Doryopteris*, *Gymnogramme*, *Saccoloma*, *Dennstædtia*, *Lindsaya*, *Gleichenia*, *Marattia*, *Botrychium*, *Lycopodium*, and *Selaginella*. Among these are twenty new species, here described. A plate gives reduced figures of 13 species of *Gleichenia*, showing the node of branching in the frond. Finally five new species from Guatemala are described and one from South Brazil.

North American Ferns.—L. M. Underwood † enumerates the ferns that have been added to the flora of the United States from 1900 to 1905. These amount to 47, apart from doubtful records, and are partly due to the opening up of the tropical part of Southern Florida, and partly to the closer analysis that has been given to such genera as *Selaginella*, *Isoetes*, and *Botrychium*. Also the types preserved in European herbaria have been examined by the author; and the West Indian fern collections now accumulated at New York Botanic Garden surpass in richness and completeness any to be found in Europe. Among the five new species are two from Florida that often grow together on limestone rocks, *Asplenium verecundum* Chapm., and *A. Curtissii* Underw. These have long posed under the names *A. myriophyllum* or *A. rhizophyllum*, both of which came originally from the West Indies. E. Brainerd ‡ records the discovery of *Nephrodium filix-mas* at Hartland, Vermont, by N. Darling. It was previously known in N. America in the north only—Gaspé, Quebec, Nova Scotia, and Michigan; and, save in the last-named, was unknown in the United States. T. E. Hazen § also records this discovery—an addition to the flora of New England. Other ferns of a northerly type are known from the town of Hartland. W. N. Clute ‖ treats of tropical ferns in the southern States, giving notes on distribution and suggestions for further work in these States.

The Fern Flora of Connecticut.¶—C. H. Bissell records 74 species, independently of varieties, of ferns and fern allies from this State. Connecticut has an average width of about 60 miles from N. to S., and a length of over 90 miles from E. to W. Its highest point is 2355 ft. Three of the ferns here recorded, *Cheilanthes lanosa*, *Asplenium pinnatifidum*, and *Asplenium montanum*, are not known elsewhere in New England, and these Connecticut stations are supposed to be the northern limit of their range. In the United States, *Marsilia quadrifolia* has hitherto only been recorded from Bantam Lake Station, Connecticut.

Hybrid Ferns.**—G. E. Davenport describes a hybrid *Asplenium* resembling *A. Trichomanes* in its brownish-black stipes and lower part of rachis, and in the shape of its upper pinnæ, and resembling *A. Ruta-*

* Bull. Herb. Boissier, vi. (1906) pp. 177–92, 279–94.
† Bull. Torrey Bot. Club, xxxiii. (1906) pp. 189–205.
‡ Rhodora, viii. (1906) pp. 22–3.
§ Fern Bulletin, xiv. (1906) pp. 25–6.
‖ Tom. cit., pp. 24–5.
¶ Tom. cit., pp. 1–11.
** Rhodora, viii. (1906) pp. 12–15.

muraria in the length of its stipes, in the green upper part of rachis, the distant pinnæ, and the tripartite lower pinnæ. It was found at Proctor, Vermont, U.S.A., by G. A. Woolson, who, suspecting the anomalous plant to be a cross between the above species, made a most careful search for the parent species. *A. Ruta-muraria* grew abundantly close by, but *A. Trichomanes* could be found no nearer than 125 ft. from the hybrid. No plant of *A. viride* could be found at all. Similar hybrids in Europe have been described by Christ and others. Davenport discusses the capacity of the wind for mingling spores brought from a distance. M. Goldschmidt* has drawn up a key for the determination of the hybrids and forms of *Athyrium filix-femina* Roth., growing wild in middle Europe. The key is founded on external and obvious characters, and is worked dichotomously; it comprises 48 forms. Appended is a bibliography of 22 works.

CHRISTENSEN, C.—**Index Filicum.** (Index of Ferns.)
[Continuation. *Leptochilus decurrens—Polypodium Beccarianum.*]
Copenhagen: Hagerup, 1906, fasc. 7, 8, pp. 385–512.

Muscineæ.

(By A. Gepp.)

Notes on British Mosses.—W. E. Nicholson† describes an interesting hybrid between *Weisia crispa* Mitt., female plant and *W. microstoma* C.M., male plant. He found it in a rough stony field on the chalk downs near Lewes, where the capsules mature towards the end of March. A full description of this hybrid is given. No trace was found of reciprocal hybridity. J. A. Wheldon and A. Wilson‡ enumerate 23 mosses and 12 hepatics among their additions to the flora of West Lancashire, and mark 12 of them as new records for the county. *Lophocolea bidentata* var. *rivularis* Raddi, is a new record for Britain, and a description of this variety by Warnstorf is inserted.

Notes on European Mosses.§—N. C. Kindberg adds to the information already existing about *Grimmia sardoa* De Not. It differs from *G. trichophylla* in having smaller leaves, shortly acuminate, often arcuate when moist. The cells are smaller, almost all very sinuous, the alar cells shortly rectangular. In *G. Lisæ* the leaf-cells are wider (as in *G. trichophylla*), less or but little sinuous, and the hairs denticulate. The second note records *Pleuroweisia Schliephackei* Limpr., from Tyrol. It is very rare, having been found previously only in the east of Switzerland and in the Caucasus. When sterile it is easily confounded with *Weisia calcarea*, but is distinguished by its inflorescence, and the leaf-margins are often reflexed.

Antarctic Mosses.‖—J. Cardot has examined the moss collections brought home by the 'Belgica' Expedition, the Swedish Expedition, the

* Hedwigia, xlv. (1906) pp. 119–23.
† Rev. Bryolog., xxxiii. (1906) pp. 1–2.
‡ Journ. of Bot., xliv. (1906) pp. 99–102.
§ Rev. Bryolog., xxxiii. (1906) pp. 30–1.
‖ Comptes Rendus, cxlii. (1906) pp. 456–8.

Charcot Mission, and the 'Scotia,' as well as those collected at Geikie Land by Borchgrevinck. Form all these collections he finds that 46 species actually occur in the Antarctic region proper, and he notes that of all the specimens examined only 4 were in fruit and 2 bore inflorescences; all the rest were absolutely sterile. The 46 species are divided between 13 families, of which the best represented is Bryaceæ. The endemic genus, *Sarconeurum*, is represented by the single species *S. glaciale*, which occurs at the two widely distant localities of Cockburn Island and Geikie Land. Twenty-two species are peculiar to the Antarctic region, and only 12, which are almost all cosmopolitan, are recorded also as Arctic species, though several Antarctic mosses are very closely related to already known Arctic forms. Altitude of habitat seems to have no appreciable influence on the distribution.

Arctic Mosses.*—P. Dusén publishes an account of the mosses of East Greenland and Jan Mayen, gathered by himself on Nathorst's expedition. In 1874, some 71 species were recorded from East Greenland; and this total was raised to 194 in 1891 by Hartz's collection, to which Dusén has now added 24 species, including 3 *Bryums* new to science. In Jan Mayen he also discovered 2 new species of *Bryum*. In the introduction the general aspect of the moss-flora of the region, and the special characters of the localities explored by him, are discussed.

Mosses of Asia.—V. F. Brotherus† contributes some notes on the moss-flora of Eastern Asia, namely East Siberia, Mongolia, and China, with a list of species collected by J. Palibin in 1889, and by others. The species, with the exception of six, are found also in Europe.

E. G. Paris‡ gives a list of 23 mosses and 1 hepatic collected in China, Saigon, Singapore, and Ceylon, by an engineer and a missionary. Four new species are described: *Campylopus singaporensis* Fleisch., *Leskea scabrinervis* Broth. et Par., *Rhynchostegium brevipes* Broth. et Par., and *Hylocomium isopterygioides* Broth. et Par. The distribution of some of the other species is enlarged by the collections here recorded.

Mosses of Hungary.§—I. Györffy continues his contributions to the bryology of the Hohe-Tatra mountains, and in the present paper he deals with the following species, on which he makes critical remarks: *Hymenostomum squarrosum* Bryol. germ., *Fissidens decipiens* De Not., *Schistidium alpicolum* Limpr., *Leptobryum pyriforme* Schimp., and *Polytrichum alpinum* L. nov. var. *flavisetum*. This new variety resembles var. *arcticum* Brid., but differs from it and from typical *P. alpinum* in having a seta which is light lemon-yellow throughout its whole length.

Spanish Mosses.‖—A. Casares Gil describes the mosses found by him on the mountain of Montserrat. He says they are very abundant, the commonest being *Hypnum molluscum* and *Neckera crispa*. Twenty species of hepaticæ are recorded, and 63 mosses. To this list are added

* Beih. Svensk. Vet. Akad. Handl., xxvii. pt. 3, i. (1901) 71 pp., 2 pls., map, and figs.
† Trav. Troitz. Kiakhta Amour Soc. Imp. Russ. Géogr., vii. (1904) pp. 10–19.
‡ Rev. Bryolog., xxxiii. (1906) pp. 25–27.
§ Magyar Bot. Lapok., v. (1906) pp. 25–31 (1 pl.).
‖ Boll. R. Soc. Españ. Nat. Hist. Madrid, v. (1905) pp. 459–64.

two hepatics and 14 mosses recorded from Montserrat by E. Boutelou, and not included in the author's own collections. Two further species are recorded by Lagasca, but one of these, *Hypnum cristacastrensis*, is regarded by the author as being probably the *H. molluscum* so common on the mountain.

North American Mosses.*—J. M. Holzinger has just issued the last fascicle of Century II. of the "Musci Acrocarpi Boreali-Americana," and A. J. Grout gives a list of 24 specially interesting plants included in the last two fascicles. Several experienced collectors are at work in Florida and North-west America.

A. J. Grout † publishes a list of additions to the Bryophyte flora of Long Island, which includes five species of hepaticæ and 45 species of mosses, collected by himself and other botanists.

J. M. Holzinger ‡ has found a sterile species of *Grimmia* on a ledge of lime rock in Winona County, Minnesota. He submitted it both to Dixon and to Cardot, and gives the opinions of each. They agree in determining it to be *G. glauca*, though it differs from the type in having longer, stouter, and rougher hair point, and a less glaucous colour. The author discusses the possibility of *G. glauca* being a hybrid. He holds that the geographical distribution of the plant would tend to argue for its value as a good species.

Notes on Sphagnum.§—C. Meylan has made careful researches on those species of *Sphagnum* in the Jura mountains which compose the section *Acutifolia*. This section is represented in that region by ten species, all carved out of the ancient *S. acutifolium* Ehrh. The characters on which these species are found are (1) the form of the cauline leaves; (2) the system of pores; (3) the position of the chlorophyll cells; (4) the position of the branch leaves. As to the presence or absence of fibres, it is such a variable and inconstant character that it is not worth taking into account. Each of the four specific characters mentioned above is dealt with fully. The species represented in the Jura are *S. fimbriatum* Wils., *S. Girgensohnii* Russ., *S. Russowii* Warnst., *S. rubellum* Wils., *S. fuscum* Kling., *S. Warnstorfii* Russ., *S. quinquefarium* Warnst., *S. subnitens* Russ. and Warnst., *S. molle* Sull., and *S. acutifolium* Ehrh. These are arranged in tabular form showing their respective connection with *S. acutifolium*.

E. Ballé ‖ gives a list of 11 species of *Sphagnum* from Vire, Calvados.

Sphagnum in Essex.¶—F. J. Chittenden gives an account of the bog mosses of Essex, with a revision of the old records, and defines the distribution of the species at the present day. Adopting Warnstorf's system of classification, he enumerates 12 species under which are grouped 14 varieties. The peculiar conditions of well-lighted stagnant water supply which the Sphagnaceæ require occur at a few places only in Essex, namely where the Bagshot Sands or Glacial Gravel overlie the impervious Boulder Clay or London Clay. Possibly the large amount

* Bryologist, ix. (1906) p. 24.
† Tom. cit., pp. 26–8.
‡ Tom. cit., pp. 29–31.
§ Rev. Bryolog., xxxiii. (1906) pp. 17–24.
‖ Tom. cit., pp. 29–30.
¶ Essex Naturalist, xiv. (1906) pp. 111–16.

of lime in the Boulder Clay is inimical to the occurrence of Sphagnaceæ on that stratum.

Flora of Kew Gardens.—E. S. Salmon* gives a list of 109 species of mosses and 7 varieties collected in the Royal Botanic Gardens, Kew, in 1897–8. Most of these he considers to be truly wild; others found only on the rockery were probably introduced on stones from Cheddar and Bath; and a few on stems of tree-ferns are exotic. Notes on critical and peculiar forms are added. C. H. Wright† adds a list of 15 hepaticæ, 8 of which occur in fern houses and pits, 4 on the rockery, and 3 in the open; and 3 of them are exotic.

New Form of Orthotrichum cupulatum.‡—C. Meylan describes a new form of this variable species under the name of sub-species *O. juranum*. He has found it on dry rocks facing N. or N.W. on the summits of the Jura Mountains. He regards this sub-species as of equal rank with *O. nudum* and *O. sardagnanum*. The peristome teeth are always split, almost, sometimes quite, to their base, and the dorsal and ventral surfaces of these teeth are very finely striate, sometimes almost smooth, or finely papillose. Other constant characters are noted, and a detailed description of the sub-species is given. A key to the four sub-species of *O. cupulatum* Hoffm. shows the constancy and value of the respective characters of each.

Germination of Moss Spores.§—P. Becquerel gives the result of his experiments in the germination of the spores of *Atrichum undulatum* and *Hypnum velutinum* in different sterilised liquid media. He comes to the conclusion that all the morphological differences of the protonema depend much more on the species, age, light, exhaustion of food supply, and aquatic or aerial media, than the different chemical compositions of the three liquids in which the plants were grown. After about 7 or 8 months of existence the plant may throw out spherical cells in which the protoplasm and the nucleus surround themselves by a thick cellulose membrane, and await a favourable opportunity for further division. This condition is attributed by the author to age or to exhaustion of the food-supply. The distribution of light has a considerable influence on the germination of the spores and on the position of the primary axes of the protonema, especially in *Atrichum*. Finally, he states that aerial and liquid media have an exactly opposite effect one to the other. The former encourages extreme development of the protonema and discourages, or even arrests, the formation of buds. The liquid medium restrains the growth of the protonema and hastens the production of both buds and rhizoids, the latter imbibing nutriment from the liquid.

Sexuality of Spores in Dioicous Mosses.‖—A. Gilkinet gives a résumé of a paper by E. and E. Marchal, in which the following two questions are discussed: 1, whether or not all the spores of one and the same moss-capsule are of the same sex; 2, whether the protonemas are

* Kew Bull., add. ser., v. (1906) pp. 91–100. † Tom. cit., pp. 101–2.
‡ Rev. Bryolog., xxxiii. (1906) pp. 3–5 (figs in text).
§ Rev. Gén. Bot., xviii. (1906) pp. 49–66 (8 figs.).
‖ Bull. Classe Sci. Acad. Roy. Belg., 1905, pp. 638–41.

unisexual or whether they bear male and female inflorescences. The authors answer these questions after observing for some months pure cultures of *Barbula unguiculata*, *Bryum argenteum*, and *Ceratodon purpureus*. Detailed descriptions are given of the precautions taken for obtaining pure cultures, the composition of the nutritive solution employed, sterilising methods, etc. The authors find that the spores of one and the same capsule give rise to protonemas of different sexes. The fructifications of a second year's stem are always of the same gender as those of the preceding year. Protonemas are either male or female, and they never produce organs of both sexes. Secondary protonemas, i.e., those arising from adult stems under certain conditions, retain the sex of the stem from which they arise. Physical external influences, such as modifications of nutritive media, etc., do not affect the sexuality of the protonema.

Key to British Hepatics.* — S. M. Macvicar publishes a revised key to the British Hepatics. For the benefit of beginners it is planned largely on superficial characters. Advice is given in the preface as to how specimens ought to be examined, and as to the importance of determining the position and character of the perianth, and the nature of the inflorescence. A fundamental factor in the grouping of the genera is found in the underleaves—their absence or their relative size when present. Keys to the species are added under the genera.

New British Hepatic.† — W. H. Pearson describes and figures *Porella lævigata* var. *killarniensis*, a new variety found by him at Killarney in 1905. He has re-examined this variable species, and arranged the numerous specimens which he has studied into four groups. The typical form has the antical leaf-lobes acute, with two or three teeth near apex. Var. *acuta* Pears., is much commoner, and has the antical lobes acute, often apiculate, uncinate, margin entire. Var. *subintegra* Kaal., has margin entire, apex rarely acute. The new var. *killarniensis* is an extreme development of the typical form, usually larger, lighter in colour, pale green above, ochraceous below; it grows in loose graceful tufts, and has the antical leaf-lobes spinulose-dentate above the middle. The polished cuticle and acrid taste refer this variety to *P. lævigata*.

British Hepatics.—W. Ingham ‡ records an important variety of *Kantia trichomanis*, which he describes under the name of var. *aquatica*. Hitherto it has been found in only two localities, Buckden Pike and Deepdale, both in Upper Wharfedale. Its main characteristic lies in the very decurrent leaves, which give the stem a winged appearance, and in the ovate and deeply-divided stipules. The author records also 32 hepatics and 42 mosses as rarities in Yorkshire and Durham, and adds a note on teratology in mosses. C. E. Larter § gives a list of 19 hepatics, apparently not previously recorded for North Devon, and a similar list of 12 for South Devon. J. A. Wheldon ‖ confirms his previous record of *Marchantia polymorpha* var. *aquatica* as occurring at

* Eastbourne: Sumfield (1906) 19 pp.
† Journ. of Bot., xliv. (1906) pp. 81–3 (1 pl.).
‡ Rev. Bryolog. xxxiii. (1906) pp. 6–13 (figs. in text).
§ Journ. of Bot., xliv. (1906) p. 105. ‖ Tom. cit., pp. 105–6.

Netherton, near Liverpool. It is an addition to the British flora, and grows erect in an ancient bog with *Sphagnum obtusum*, *S. teres*, *Mnium affine* and *Hypnum cordifolium*. A second station for the plant is near Rainford Junction, Lancs.

Hepaticæ of Bermuda.*—A. W. Evans gives a list of the hepatics of Bermuda, of which not much was known previously. Mitten, in the 'Challenger' Report (1884), recorded 6 species; since then 3 more species have been added. Evans has worked up 6 recent collections, and raised the total of species in the Bermudan flora to 23. The affinities of this subtropical flora are with that of the Eastern States, where more than half the species are found. Twelve occur in the British Islands, and about as many in the West Indies. The one new species, *Crossotolejeunea bermudiana*, is of tropical American affinity.

Hepaticæ of New England.†—A. W. Evans publishes the fourth and final part of his notes on New England Hepaticæ. He says that but few additions have been made to the flora of New England during the past year, and that most of the additions here noted have come to light through the study of old material. All the species mentioned in this contribution, with the exception of *Frullania arborescens*, are common to Europe. Notes are added on species from Rhode Island and from Cumberland, Maine; and the census of New England species completes the paper.

Hepaticæ of Puerto Rico.‡—A. W. Evans contributes the sixth part of his studies on the hepaticæ of this region. It includes the genera *Cheilolejeunea*, *Rectolejeunea*, *Cystolejeunea*, and *Pycnolejeunea*. The second and third of these genera are new. *Rectolejeunea* contains 4 species, one of which is new; *Cystolejeunea* contains one species formerly known as *Lejeunia lineata* Lehm. and Lindenb. Critical notes and detailed descriptions are appended to the species names, together with synonymy.

Hepaticæ of New Caledonia.§—E. G. Paris gives an interesting list of hepaticæ collected by MM. Etesse and Le Rat in the south of New Caledonia, and determined by Stephani. Of the 53 species recorded, 19 are new and 9 are endemic. Three other genera are represented by fragments of plants, which are insufficient for specific determination. The above proportion of endemic species is unique.

Riccia.‖—C. E. Lewis describes the embryology and development of *Riccia lutescens* and *R. crystallina*. The former species is shown to be a terrestrial form of *Riccia natans*. It is monoicous, and produces antheridia and archegonia in the autumn and ripe spores in the following spring; it is also propagated vegetatively by the separation of thalline branches. In both this species and in *R. crystallina* the development of the sexual organs and fruit agrees with that described for other species

* Bull. Torrey Bot. Club, xxxiii. (1906) pp. 129-35 (1 pl.).
† Rhodora, viii. (1906) pp. 35-45.
‡ Bull. Torrey Bot. Club, xxxiii. (1906) pp. 1-25 (3 pls.).
§ Rev. Bryolog., xxxiii. (1906) pp. 27-29.
‖ Bot. Gazette, xli. (1906) pp. 109-38 (5 pls.)

of the genus. Bodies resembling centrosomes occur in the cells of the antheridium, and persist, and later become blepharoplasts. The development and cytology of the antherozoids, spore-mother-cells, and spore are described.

Genus Scapania.* — K. Müller has completed and published an exhaustive monograph of this difficult genus. The work, which has taken years to carry out, is divided into two parts, the general and the special part. Preceding these is a list of bibliography and exsiccatæ quoted in the book. The general part opens with a list of herbaria, collections, and published sets examined by the author, and the names of the specimens represented therein. Then follows a detailed disquisition on the geographical distribution of the genus all over the world, ending with the results presented in the form of tables. The special part deals with the systematic side of the work, and after giving the synonymy and diagnosis of *Scapania* the author describes the morphology of the genus under the headings of habit, stem, leaves, areolation, cuticle, sexual organs and their envelope, etc. The species are divided into three main groups: 1, Perianth compressed; 2, Perianth unknown; 3, Perianth not compressed. The author remarks that the best systematic character of *Scapania* is the form of the leaf-lobes and their proportionate size. Each species is treated with the utmost detail from a descriptive, critical, and geographical point of view. Six new species are described. The book is illustrated by 52 large quarto plates, containing figures of habit and structure of each of the 65 species recognised.

Regeneration of Liverworts.†—Anna Berkovec gives the results of her investigations of the regeneration of liverworts. For this all liverworts have a remarkable capacity. There is a strong correlation between the growth of the potential growing point and the formation of adventive shoots which arise after a wound. The fewer the potential growing points, the greater the capacity for producing new thalli. These latter arise most frequently from superficial cuts near the apex or along the thallus, or even near the base; there is therefore no polarity. They may also arise from uninjured tissue above or below the thallus. The adventive shoot has at first a radial structure which soon becomes dorsiventral. The regenerating portion of thallus determines the plane of dorsiventrality of the new shoot. The author describes her apparatus and methods.

CHYZER, K.—**Adatok északi Magyarország, különösen Zemplénmegye és Bártfa sz. kir. város flórájához.** (Additions to the flora of North Hungary, especially the districts of Zemplén and Bártfa.)
[Contains a list of 48 mosses and 3 hepatics, revised by Mágócsy-Dietz.]
Magyar Bot. Lapok, iv. (1905) pp. 308–10.

GYÖRFFY, I.—**Hypnum arcuatum. Plagiopus Œderi. Pterygoneurum cavifolium.**
[Notes on these three mosses as occurring in Hungary.]
Tom. cit., pp. 339–40.

* Nov. Act. Acad. Caes. Leop.-Car. Germ. Nat. Cur., lxxxiii. (Halle, 1905) 312 pp., 52 pls.

† Bull. Internat. Acad. Sci. Bohême Prague (1905) 19 pp., 1 pl.

GYŐRFFY, I.—**Ueber das Vorkommen der Catharinaea Hausskneohtii Broth. in der Gegend von Debreczen.** (On the occurrence of *C. Hausskneohtii* in the region of Debreczen.)
[The author sums up the differences between this species and *C. undulata*, and adds a new locality to the distribution of *C. Hausskneohtii*—Debreczen, in Hungary.]
Op. cit., v. (1906) pp. 33-6.

HERZOG, TH.—**Die Laubmoose Badens.** (The mosses of Baden.)
[A continuation, in which the distribution of the species in the Black Forest and Jura is discussed.]
Bull. Herb. Boissier, vi. (1906) pp. 235-44, 326-41.

PARIS, E. G.—**Index Bryologicus.**
[Continuation. *Thedenia—Zygodon.*]
Ed. 2, v., fasc. 25-6 (Paris, 1906) pp. 1-136.

STEPHANI, F.—**Species Hepaticarum.**
[Continuation, containing descriptions of 35 species of *Leioscyphus.*]
Bull. Herb. Boissier, vi. (1906) pp. 217-32.

WATTS, W. W.—**Australian Mosses. Some Locality Pictures.**
[Field notes of an expedition in the district of Young, New South Wales. To be continued.] *Bryologist*, ix. (1906) pp. 34-6.

Thallophyta.

Algæ.

(By E. S. GEPP.)

Fresh-water Algæ of the Azores.*—K. Bohlin has made a study of the fresh-water algæ of these islands, but he does not pretend that this is in any way complete, as his collections were made during one dry season, June to August, only, and were for the most part confined to one island. The number of species now known from the Azores is 171, of which 158 were found by the author, 134 of these being new to the islands. One new species and one new variety are described, and a new genus, *Chlorobotrys*, is formed for the reception of *Chlorococcum regularis* West. The author treats his subject under the following headings: General sketch of the nature of the Azores; the lacustrine algæ; the algæ of the marshes and streams; aerial algæ; the algæ of the hot springs; general character and origin of the algal flora; systematic list of the fresh-water algæ of the Azores; list of localities; bibliography.

Fresh-water Algæ of South Patagonia.† — O. Borge has made collections of fresh-water algæ at various localities in South Patagonia, between Punta Arenas on the north coast of the Magellan Straits, and Santa de los Baguales, about 50° 10′ S. lat. and 72° 5′ W. long. He records about 150 species, and states that the small number of species is probably due to the saline character of the soil. Certain genera, such as *Arthrodesmus*, *Micrasterias*, *Penium*, *Tetmemorus*, and *Xanthidium*, are not represented at all, while *Euastrum* has only three, and *Pleurotænium* only one species. Six new species and several new varieties are described.

* Bihang. K. Svensk. Vet. Akad. Handl., xxvii., pt. 3, iv. (1901) 85 pp., 1 pl.
† Tom. cit., pt. 3, x., 40 pp., 2 pls.

Fresh-water Algæ in Kew Gardens.* — F. E. Fritsch writes an account of the fresh-water algal flora of Kew Gardens. He divides it into three groups: (1) the greenhouse flora; (2) the Thames flora, consisting of the algæ in the artificial waters and the tanks in the greenhouses; (3) the terrestrial flora, made up of species growing on damp ground, rocks and trees in the open air. The total number of genera recorded is 130, and the number of species is 294, of which the Cyanophyceæ constitute nearly 25 per cent. In the aquatic tank near the Jodrell Laboratory, a regular sequence of algal forms was observed, and this is shown in a table. The plankton of the artificial waters at Kew is, in its general character, almost the same as that of the Thames, though in quantity of individuals it is very different. There is an entire absence of Peridineæ in the Kew flora. A list of species is given, with the locality of each.

Bacillariæ from Texas and New Mexico.† — A. M. Edwards describes fossil diatoms from the Staked Plain, which includes part of Texas and part of New Mexico. He gives a description of the district with its boundary limits, followed by a list of the 67 diatoms recorded from there; notes are given on many of the species, as well as on the geology of the district.

Diatoms from near Lake Chad.‡—P. Petit and H. Courtet issue a preliminary note on the diatoms observed in sundry geological specimens collected by the Chari-Lac Tchad expedition. Diatoms have been found which, though fossil, are of a recent age, since they are represented in fresh-water at the present day. The deposits in question are from Ardèbe and Mondo. At the former place the genera *Gomphonema*, *Cymbella*, and *Epithemia* are the most common, and the following species occur: *Cymbella cucumis*, *Navicula obtusa* var. *lata*, *Navicula æquatorialis*, and *Eunotia gibbosa*. The calcareous deposit in which they were found is at a depth of 40 metres. In the calcareous tufa of Mondo were found large numbers of Cymbellæ, as well as specimens of *Stephanodiscus astræa* Ehrb., and *Surirella arcta* A. S., which is very abundant. This species has only been found hitherto in the Demerara river, where it is living. The tripoli of Mondo is almost entirely formed of common species of *Cyclotella*, *Gaillonnella*, and *Cymbella*.

Yorkshire Diatoms.§—R. H. Philip publishes the records of diatoms collected on two excursions by the Yorkshire Naturalists' Union in 1905. The localities were the Givendale Springs and the Ousethorpe Brook near Pocklington, and Maltby. The most interesting find was a variety of *Fragillaria capucina*, not hitherto described. Instead of the constriction in the median portion of the valve, characteristic of var. *mesolepta*, there is in the new variety a distinct dilatation.

Sargassum filipendula.‖—E. B. Simons has made a morphological study of this species, and presents her results under the headings of:

* Kew Bull., add ser. v. (1906) pp. 187–220.
† Nuov. Not., xvii. (1906) pp. 61–9.
‡ Comptes Rendus, cxlii. (1906) pp. 668–9.
§ Naturalist, Jan. 1906, pp. 14–15 (figs. in text).
‖ Bot. Gazette, xli. (1906) pp. 161–82 (2 pls.).

material and methods; general morphology and histology; origin and development of the conceptacle; origin and development of the cryptostoma; spermatocyst; oocyst; and sporeling. Growth takes place from a 3-sided apical cell, which gives rise to stem, branch and leaf structure. The tissues contain much reserve material, partly oil, partly perhaps a carbohydrate. Conceptacles and cryptostomata originate in a single flask-shaped initial cell, which divides at first into two dissimilar segments—a large lower cell which gives rise to the walls of the conceptacle or cryptostoma; and an upper cell, the "tongue" cell, which either remains inactive, or divides to form a short filament, or degenerates. The author holds the view that cryptostomata have been derived from conceptacles, whose sexual organs have become sterile. The oocyst normally gives rise to but one egg.

New American Coralline Algæ.*—M. Foslie and M. A. Howe describe seven new species and four new varieties of Corallines, from various parts of the West Indies. In some of the species described the material is entirely sterile, and in others empty conceptacles have been found. But the plants possess such well-marked distinctive characters in outward form or internal structure that the authors consider the descriptions and photographs will prove sufficient for identification. Photographs are given of the habit and structure of the various species and varieties.

Morphology of Caulerpa.†—J. M. Janse gives an account of his studies of the polarity and organ-formation in *Caulerpa prolifera*. He treats his subject under the following headings: (1) Polarity and streaming of protoplasm as occurring in branchlets, either wounded or reversed; (2) Polarity and organ-formation, firstly the formation of new members, such as branchlets, rhizome, rhizoids; and secondly changes in the protoplasm during the formation of new growths; (3) Theoretical considerations. A full summary is appended. In brief, *Caulerpa prolifera* exhibits a well-marked polarity, which is seen both in the course of the stronger protoplasmic streams in intact and in wounded branchlets, and also in the formation of organs as the result of severe wounds.

Regeneration in Polysiphonia.‡—F. Tobler has studied the question of regeneration and polarity in *Polysiphonia* (4 species) and *Ceramium* (3 species). After describing his method of treatment, he passes on to discuss the artificial control of growth in uninjured specimens, including unequal growth in definite parts, adventitious shoots, rhizoid-formation; next, growth in injured specimens (the shedding of parts followed by regeneration); and finally, the question of polarity.

Complementary Chromatic Adaptation of Algæ.§—M. Gaidukov gives an account of some most instructive experiments made by him on *Porphyra laciniata* Ag. and *Phormidium tenue* Gom. The apparatus and methods of work are described and the following results are arrived at. The

* Bull. New York Bot. Garden, iv. (1906) pp. 128-36 (14 pls.).
† Jahrb. wiss. Bot., xlii. (1906) pp. 394-460 (3 pls.).
‡ Tom. cit., pp. 461-502 (3 pls.).
§ Ber. Deutsch. Bot. Ges., xxiv. (1906) pp. 1-5.

length of time which is required to produce complementary chromatic adaptation depends on the strength of the light. Chromophylls have the power of photographing the colours complementarily. The speed of the process shows that it is here a question of actual change of colour of the old cells, not the formation of new cells with differently coloured chromophylls. In the macroscopic experiments only two main complementary colours are to be seen, green and red, blue-green and brown-yellow, not the various intermediate shades. Complementary colour-change depends on the change of structure of the chromophylls. Finally, the author answers the questions raised by Oltmanns on this subject in the second volume of his "Morphologie und Physiologie der Algen," p. 196.

HOLTZ, L.—**Neue Fundorte von Characeen auf der Insel Sizilien, von Dr. Ross.** (New localities for Characeæ in Sicily, discovered by Dr. Ross.)
[A list of 14 species and varieties, containing one new variety, *pseudo-spinosissima*, of *Chara crinita* Wallr. A detailed description is given.]
Nuov. Notar., xvii. (1906) pp. 57–60.

KEISSLER, K. v.—**Beitrag zur Kenntnis des Planktons einiger kleinerer Seen in Kärnten.** (Contribution to a knowledge of the plankton of some rather small lakes in Carinthia.)
[Describes the plankton of five small lakes, and makes remarks on the distribution of the species here recorded.]
Oest. Bot. Zeit., lvi. (1906) pp. 53–60.

MAZZA, A.—**Saggio di Algologia oceanica.** (Essay on oceanic algology.)
[A continuation, which includes *Caulacanthus*, *Gelidium*, *Pterocladia*, and *Suhria*.] *Nuov. Not.*, xvii. (1906) pp. 41–56.

MIGULA, W.—**Thomé's Flora von Deutschland. V. Kryptogamen.** (Flora of Germany. Cryptogams.)
[Diatomaceæ, continued. *Diploneis—Navicula*.]
Gera: Zezschwitz, 1906, lief. 26, pp. 225–56 (5 pls.).

SETCHELL, W. A.—**Regeneration among Kelps.**
Univ. Californian Publications, ii. (1905) pp. 139–68 (3 pls.).

STOCKMAYER, S.—**Kleiner Beitrag zur Kenntnis der Süsswasseralgenflora Spitzbergens.** (Small contribution to the freshwater algal flora of Spitzbergen.)
[A list of 29 species, of which one, *Euastrum Wiesneri*, is new.]
Oest. Bot. Zeit., lvi. (1906) pp. 47–53 (7 figs. in text).

Fungi.

(By A. LORRAIN SMITH, F.L.S.)

Urophlyctis Alfalfæ.*—E. S. Salmon detected this fungus on the roots of *Lucerne* from Herne Bay, where it had caused the death of a good many plants. The fungus, one of the Chytridineæ, forms gall-like structures from the hypertrophied tissue of the host. These galls contain a number of minute chambers which are filled with the brownish spores. The disease was first observed in Ecuador. This is the first record of the disease in Britain.

Morphology and Development of Empusa.†—Edgar W. Olive begins with an historical sketch of the investigations that have already

* Gard. Chron., xxxix. (1906) p. 122.
† Bot. Gazette, xli. (1906) pp. 192–208 (2 pls.).

been made on this genus of Entomophthoreæ, especially by Cohn, Brefeld, and Thaxter. He was fortunate enough to find a small fly belonging to the genus *Sciara* on some horse-dung cultures in the laboratory which was attacked by a species of *Empusa*. He got a large series of the insects representing every stage of the life-history of the fungus, and the description of the new species *E. Sciaræ* is the main subject of the paper. The fly lays its eggs on the surface of the dung or on the sides of the vessel, and infection must take place at a very early stage in the life of the insect, as adult larvæ were not induced to take the disease. If the cultures were kept moist the majority of infected individuals died at the larval stage. If the conditions were drier the adult fly, even when attacked, was developed, and only died of disease after ovipositing. Olive found the earliest stage of vegetative hyphæ in the larvæ. At first they were multinucleate and non-septate, then, later, septa were formed and the body-cavity became filled with hyphæ. The fructifying stage occurs on the death of the insect. Rhizoidal hyphæ are formed which attach the insect to the substratum, and conidiophores, simple or branched according to the species, rise from the vegetative hyphæ. These bore their way through the tissue of the host and produce conidia at the apex. In some species the cœnocytic conidiophore divides up into uninucleate cells, and the conidium also is uninucleate. In *Empusa muscæ*, where the conidium is multinucleate, only one septum is formed in the conidiophore immediately below the conidium. The resting-spores—zygospores or azygospores—are formed on larger hyphæ. Olive describes also the abjection of the conidia. The process is somewhat similar to that described for the sporangium of *Pilobolus*.

Study of Saprolegnieæ.*—Paul Dop has tested the influence of certain substances on the development of *Saprolegnia Thureti*, the parasite of fishes. If the conditions are anaerobic the hyphæ are more slender, the older parts more septate, and the grains of cellulin are smaller. Carbon can be supplied to the fungus as glycogen. In mineral solutions there is no cellulin formed and growth is slow, while the septa are numerous.

Fertilisation in Mucorini.†—Dangeard gives an historical sketch of our knowledge of this subject. He then draws attention to the fact that in conjugation in this group of fungi we have the union of gametangia. He followed the process more especially in *Mucor fragilis*, and noted the union of a number of nuclei, the mature zygospore containing many fused nuclei which provide those of the new thallus.

Witches' Broom on Cherry.‡—Emil Heinricher considers that the deformations caused by *Exoascus Cerasi* are favourable objects for studying physiological phenomena. He transferred the disease from one tree to another by grafting, and found that spontaneous infection by spores is of rare occurrence.

* Bull. Soc. Bot. France, lii. (1905) pp. 156–8.
† Comptes Rendus, cxlii. (1906) pp. 646–7.
‡ Naturw. Zeitschr. Land. Forstw., iii. (1905) heft 8, pp. 344–7 (1 fig.). See also Hedwigia, xlv. (1906) Beibl., pp. 106–7.

Variation in Phyllactinia corylea.*—E. S. Salmon finds a remarkable variation in the conidial form of this species. The fungus grows on a great variety of hosts (some 130 species, belonging to 52 genera), and the author has gone through the material, examining and comparing the *Oidium* whenever it was present. On certain hosts he finds constant morphological differences in the conidial form; two varieties are marked by the form of the conidiophore: var. *rigida*, where it is rigid and acicular, and var. *subspiralis*, where it is thick-walled and tortuous. Another variety, *angulata*, is based on the shape of the conidia. Salmon thinks that we have here an instance of a species which is undergoing, or has lately undergone, a mutation period. The peculiar conidia in the variety *angulata* occur on a wide range of host-plants, and it is a curious fact that while this variety is found on such trees as *Quercus*, *Fagus*, and *Ulmus* in America, in Europe the conidia found on trees of these genera show the characters of the type. This seems to point to the theory that the peculiar shape has appeared as a "mutation" independent of any host. Salmon is also of opinion that biologic forms exist within the species, but that it is necessary "to group all such biologic forms round a clearly defined morphological centre—the systematic species or variety."

New Genus of Parasitic Fungi.†—Nicolas Jacobesco records a destructive canker of lime trees caused by a fungus new to science which he names *Trematovalsa Matruchoti*. Small longitudinal slits with a black interior are first noticed in the bark of the tree. These multiply, and the bark splits at right angles to the slit, until the stem or branch is surrounded with wounds, and is destroyed altogether, as the fungus penetrates deeper into the tissues. Jacobesco describes the perithecia of the fungus, and the 4-celled spores. He also describes the spermogonial and pycnidial forms which occur in succession on the infected areas.

Balansia and Dothichloe.‡—These two genera of Pyrenomycetes are parasitic on grasses or carices. G. Atkinson has studied the different species, and gives full descriptions. *Balansia* forms stalked or cushion-like stromata in which the perithecia are imbedded. *Dothichloe* is a new genus proposed for those forms that have a very thin black stroma. The author discusses the economic importance of these parasites, and the disastrous consequences that would follow if they spread to any extent, or if by changing their host, they should attack the more important forage plants.

Sporulation of Yeasts of Ascomycetous Fungi.§—The formation of endogenous spores in *Saccharomyces* has been considered the test whereby the true yeasts were to be distinguished from the budding stages of other fungi. P. Viala and P. Pacottet have been experimenting with several forms of fungi in this connection, and give an account of their researches. *Glœosporium ampelophagum* and *G. nervisequum*, which cause respectively anthracnosis of the vine and of the plane, were

* Ann. Mycol., iii. (1906) pp. 493–505 (3 pls.).
† Comptes Rendus, cxlii. (1906) pp. 289–91.
‡ Journ. Mycol., xi. (1905) pp. 248–67.
§ Comptes Rendus, cxlii. (1906) pp. 458–61.

selected by them for experiments which have lasted over three years. In both species they have grown a series of diverse forms, conidiophores, spermogonia, pycnidia, sclerotia, chlamydospores, and cysts. It has further been proved by Klebahn that *Glœosporium nervisequum* has a perfect ascosporous form, *Gnomonia veneta*. The writers took spores from the spermogonia of the fungus, and obtained, in sugar media, generation after generation of yeast-cells. Under certain conditions the cells became invested with an outer membrane and were brown in colour. When the yeast was grown on an exhausted medium, endogenous spores were formed. In *G. ampelophagum* there were formed 1, 2, or 3 spores, somewhat ovoid in shape, which again formed yeasts in a sugar solution. Exactly the same results were obtained with *G. nervisequum*, but in this case the endogenous spores were more numerous, varying from 2 to 12. Such results could not be obtained with other closely allied fungi.

The formation of endogenous spores has been looked on as ascus-formation, and has placed *Saccharomyces* among the primitive Ascomycetes. The results obtained by Viala and Pacottet throw considerable doubt on this view. In the life-cycle of *Glœosporium nervisequum* there would thus be two very different stages of ascus-spore formation. The view of Pasteur that *Saccharomyces* was at its origin a filamentous fungus, has also had some confirmation, though possibly it has lost all power of reverting to its original filamentous condition.

Nuclear Division in Saccharomyces ellipsoideus I. Hansen.*—Franz Fuhrmann sketches the work of previous authors on the nuclear division of yeast-cells, and then gives the results of his own research. He describes his methods of culture, fixing, staining, etc. The resting nucleus is small with a delicate structure, and is often surrounded by a clear zone, though sometimes that was not visiblé, and probably is only a vacuole. In the preliminary stages of division the nucleus increases somewhat in size, the chromatic substance becomes more condensed and forms into chromosomes, evidently to the number of four. These are seen to arrange themselves in the monaster stage; splitting then takes place, the daughter-chromosomes travel polewards, and a diaster stage is reached; the knot stage is reproduced, and finally a resting stage of each daughter-nucleus. Budding of the cells follows at a later stage than nuclear division, though sometimes the two acts are synchronous. The nucleus may pass over into the new cell at the knot stage of the daughter-nucleus or even earlier. A resting stage of both nuclei usually follows, but a second karyokinesis of the nucleus of the mother-cell may take place immediately. Fuhrmann found in his preparations no evidence that any fusion of nuclei took place in the cell previous to nuclear division representing, according to Hirschbruch, a sexual act. Figures are given of the different stages of division.

Toxin of Aspergillus fumigatus.†—E. Bodin and L. Gautier have found that this fungus produces a toxic substance bearing a strong resemblance to bacterial toxins. It reacts on the nervous centres, causing convulsions and proving fatal in a short time, or, if the dose is

* Centralbl. Bakt., xv. (1906) pp. 710–17 (1 pl.).
† Ann. Inst. Pasteur, xx. (1906) pp. 209–24.

small, the effect passes off without leaving any trace. It was found that some animals are much more susceptible than others to the poison.

Deformations Caused by Gymnosporangium.* — L. Géneau de Lamarlière has examined the differences in the effects produced on their alternate hosts by *Gymnosporangium clavariæforme* and *G. juniperinum*. He finds that the results on the tissues of the host-plant are very similar in both species. There is deformation and hypertrophy of the tissues of the parenchyma resulting in the swelling of the organ attacked, and due to the development of the mycelium of the parasite. In the action of the *Roestelia* or *Æcidium* form, the part of the plant infected is killed by the fungus; in the teleutospore form, a kind of symbiosis is established between the mycelium of the *Gymnosporangium* and the tissue of the Juniper; the effect is not fatal as in the case of the *Roestelia*. In the latter the cambium is attacked—the conducting tissue—which leads to the death of the branch or leaves attacked.

Uredineæ.—W. A. Kellerman† gives an account of his experiments with the rust of maize, *Puccinia Sorghi*, the *Æcidium* of which grows on *Oxalis*. While the rust itself is common, the *Æcidium* is rare, and the fungus is propagated from year to year by surviving uredospores.

J. C. Arthur ‡ describes in detail the cultures of Uredineæ made during 1905. In many instances previous results were verified. Negative results on new material are also chronicled. Successful inoculations were obtained in nine species not previously chronicled. A heterœcious form was proved: the *Æcidium* on *Steironema*, the *Puccinia* on *Spartina*. Here again the *Æcidium* is rare, and propagation undoubtedly due to the hardiness of the uredospores which enables them to persist during the winter and infect the plants in spring.

A large canker growth on a species of *Bignonia*, from Brazil, has been found by P. Magnus § to be caused by a new fungus, *Uropyxis Rickiana*. The mycelium of the Uredine burrows in the cortical parenchyma, and forms a spore layer, which bursts the epidermis of the host. The tissue underlying the spore layer grows vigorously, and forms a layer of cork which is burst in turn as a new spore layer is formed beneath. The presence of the fungus induces a rich formation of vascular tissue as well as of cork, and a very large canker is formed. The author found only the teleutospores of the fungus. These are two-celled, and each cell possesses two germinating pores.

Tracya Hydrocharidis Lagerh.‖—This member of the Tilletiæ was found in the leaves of *Hydrocharis Morsus-ranæ* near Stockholm by E. Renkauf-Weimar, who writes a description of it, and of the germination of the spores and the formation and fusion of the sporidia. These develop a germinating tube which penetrates the young leaves and forms abundant mycelium in the air-spaces of the spongy parenchyma; gradually a ball of hyphæ and spores is produced. The author found the fungus only on the leaves. They become brown and the spore-

* Ann. Sci. Nat., ser. 9, ii. (1905) pp. 313–50 (4 pls.).
† Journ. Mycol., xii. (1906) pp. 9–11. ‡ Tom. cit., pp. 11–27.
§ Hedwigia, xlv. (1906) pp. 173–7 (1 pl.).
‖ Op. cit., (1905) pp. 36–9 (1 pl.).

balls are visible as fine points. On the decay of the leaves the spore-balls are set free.

Revision of the Genus Hemileia Berk.*—G. Massee describes two new species of this Uredine. Only the uredospores and teleutospores are known, and it is extremely desirable that a search should be made for a possible *Æcidium*. A complete knowledge of such troublesome parasites is essential, if adequate measures are to be taken to stamp them out. *Hemileia vastatrix*, the disease of coffee-plants, has been recorded from Asia and Africa; and there are also species from Australia and America, indicating a wide distribution of the genus.

Anomalous Fungi.†—D. José Esteva cites two cases of the larger fungi which were found growing as parasites on another member of the same species. In one case the secondary fungus was in the usual upright position, in the other it was reversed and the hymenium was uppermost. He discusses the reasons that would explain this anomaly. Either the primary fungus has carried up with it a near neighbour, or the parasite has grown from spores, forming a mycelium and a new growth on the host fungus.

Gummosis in the Amygdalæ.‡—W. Beijerinck and A. Rant describe in detail their work on gummosis as affected by parasitic fungi. Wounds, especially in summer and in young twigs, induce a flow of gum. This phenomenon depends on a pathological transformation of embryonic woody tissue due to traumatic excitation. Fully formed wood is never transformed into gum—only the newly formed tissue not yet lignified. The author resumes his work in a series of propositions, thus :—

That the normal plant produces cytolytic substances, which contribute to the formation of vessels and tracheides.

Physiological gum which is formed in the process is usually re-absorbed. The flow of gum rests on the excessive activity of these cytolytic substances which are produced by necrobiotic cells, that is, cells in which the protoplasm is dead, but in which the enzymes are still active.

Poisons, such as corrosive sublimate or the poison produced by the fungus *Coryneum*, augment indirectly cytolyse in the cambium and in the young secondary wood, and induce the formation of gum canals.

The authors have found besides *Coryneum* that *Monilia fructigena* also favours gummosis, especially in the apricot, and they also found a *Cytospora* on the branches of a cherry, though its action was somewhat doubtful. The parasites produced strong poison effects, young branches being easily killed, the tissues becoming brown. The formation of gum is confined to the zone between the living and the dead tissues. In all the Amygdalæ examined they were able to produce gummosis wherever there was cambium by means of the fungus *Coryneum*.

Poisonous Nature of the Lolium Fungus.§—Eduard Hackel discusses the whole question on the basis of previous work by Wilson, who

* Bull. Roy. Bot. Gard. Kew, ii. (1906) pp. 35–42 (1 pl.).

† Bol. Hist. Nat., vi. (1906) pp. 98–100 (2 figs.).

‡ Arch. Néerl. Sci. Exact. Nat., xi. (1906) pp. 184-98.

§ Mith. Nat. Ver. Steiermark, 1904 (1905), lii.-lviii. See also Hedwigia, xlv. (1906) Beibl., pp. 92–3.

claimed that *Lolium* was non-poisonous. Hackel considers that Wilson was dealing with plants that did not contain the fungus, and that additional proof is thus afforded that the harmfulness of *Lolium temulentum* is entirely due to the fungus which lives symbiotically in the seed.

Plant Diseases.—P. Kulisch * publishes an account of a severe attack of *Peronospora* on the vine and more especially on the grapes. He considers that spraying was delayed too long.

J. Gallaud † records the mischief done to the coffee plant in New Caledonia by the fungus *Pellicularia*. It grows on the stem, leaves, flowers, or fruit, and forms a thin close pellicle of creeping, anastomosing hyphæ, which bear globose echinulate spores. It is a very serious disease, but as it is entirely superficial it is thought that a liberal use of fungicides would keep it under if not destroy it altogether. The name given to the disease is "Koleroga," or "Candellilo."

Mycological Notes.‡—Franz v. Höhnel continues his description of new species and his notes and corrections of species already known. He considers *Boletus luteus* and *B. granulatus* identical, the latter differing only in the want of the ring. He finds that *Didymosphæria conoidea* is always parasitic in the perithecium of another Pyrenomycete, *Leptosphæria Doliolum*. After careful examination he concludes that *Phyllosticta Lysimachiæ* is a development form of *Ramularia Lysimachiæ*; he has found them growing intimately together. *Stilbum byssinum*, on account of its branched conidiophores, should be placed in the genus *Dendrostilbella*. The genera *Myrothecium* and *Volutella* are compared: there is much confusion among species of these and allied genera.

Von Höhnel describes one new genus, *Lentomitella*, distinguished from *Lentomita* by markings on the spores.

Microfungi of Galls.§—A. Trotter distinguishes three types of fungi associated with insect galls—saprophytic fungi, antibiotic fungi, and symbiotic fungi. The saprophytic forms grow on the galls or on neighbouring tissues; in some cases they are probably biologic forms that find their peculiar sustenance only on galls. The antibiotic fungi live usually on the surface of the galls and are mostly parasitic, as for instance, *Glœosporium gallarum*, *Tricothecium roseum*, and *Uredo subcorticium*. The *Erineum* group of galls are especially subject to parasitic growths of fungi, such as *Alternaria*, *Penicillium*, *Aspergillus*, etc. *Marsonia Populi* was found growing luxuriantly in the interior of a gall. Here also, as with the saprophytic forms, the tissues of the gall may be peculiarly suitable for certain fungi. In some cases the fungus attacks the larvæ, and it has been observed that a poor season for fungi is followed by a season rich in gall-production. The symbiotic group of fungi live also in the tissues of the gall, but seemingly without doing any harm to the structure. It is probable that the fungus takes advantage of the secretions or excretions of the insect. Such a fungus

* Naturw. Zeitschr. Land. Forstw., iii. (1905) p. 390. See also Bot. Centralbl., ci. (1906) p. 128. † Comptes Rendus, cxli. (1905) pp. 898–900.
‡ Ann. Mycol., iii. (1906) pp. 548–60 (6 figs.).
§ Tom. cit., pp. 521–7 (8 figs.).

was found growing in the galls of *Capparis*. They occur also in galls of *Scrophularia canina* and *Verbascum*. In the latter the gall was completely closed and yet lined with the brownish olive mycelium of some fungus undetermined. It is difficult to understand its position if it is of no service to the insect. The author gives a list of all the fungi that have been recorded on galls.

Origin of Parasitism in Fungi.*—G. Massee winds up his paper by three statements: (1) The entrance of the germ-tubes of a parasitic fungus into the tissues of a living healthy plant depends on the presence of some substance, in the cells of the host, attractive to the fungus. In other words, infection is due to positive chemotaxis. (2) A saprophytic fungus can be gradually educated to become an active parasite on a given host-plant, by means of introducing a substance positively chemotactic to the fungus into the tissues of the host. By similar means a parasitic fungus can be induced to become parasitic on a new host. (3) An immune plant signifies an individual of the same species as the one on which a given species of fungus is parasitic, but which, owing to the absence of the chemotactic substance in its tissues necessary to enable the germ-tubes of the fungus to penetrate, remains unattacked. The author conducted a series of experiments to verify these statements. He used the expressed juice of leaves as culture solutions, and tested the presence of the chemotactic substance by sowing fungus spores on a mica film in which a hole had been bored and placing it in contact with the juice. If the chemotactic substance were there, the germinating-tube of the spore grew towards the hole. He also found that the chemotactic property could be destroyed by the addition of certain reagents, such as a trace of acetic acid, etc. In order to educate a plant to become host to any parasite, he injected into the tissues some substance chemotactic to the fungus. Thus he induced *Penicillium* to invade the leaves of *Tradescantia discolor* by injecting into it a solution of cane-sugar. Other saprophytic species were induced to become parasites on *Begonia* leaves by the same method, and after 15 generations they grew as parasites without any addition of a sugar solution.

Fungi of Kew Gardens.†—A long list representing 378 genera and 1762 species of fungi has been compiled by G. M. Massee. This abundant flora for such a small area is partly explained by the continual introduction of new plants and new soil from all over the world. Many of the species are exotic and grow in the greenhouses; others grow as parasites on foreign plants. Massee states that no parasitic fungus destructive to plants has been introduced to Europe through Kew. The special habitat of each plant is given, and the poisonous or edible species among the larger fungi are indicated. The list includes the Mycetozoa.

Systematic Notes.—E. J. Durand ‡ gives a complete account of *Peziza fusicarpa*, which he places in the genus *Macropodia*; he quotes a large synonymy, thus bringing into order a series of names. He places *Peziza semitosta* in the same genus. A. P. Morgan § continues the

* Phil. Trans. Roy. Soc., Series B, cxcvii. (1905) pp. 7–24.
† Kew Bull., add. ser. v. (1906) pp. 103–87.
‡ Journ. Mycol., xii. (1906) pp. 28–32. § Tom. cit., pp. 1–9.

description of North American species of *Marasmius*, Nos. 124–162. He gives diagnoses of all the species.

Pocket Atlas of Fungi.*—P. Dumée has issued a pocket atlas of edible and poisonous fungi. Popular descriptions are given of the commoner species, their classification, distribution, etc. Information is also given as to poisoning by fungi, and the best remedies in case of such an accident. The atlas contains drawings of 64 species, printed in colours and representing the fungi in their natural surroundings.

Morphological Notes.†— F. Guéguen describes the structure and development of *Rhacodium cellare*. He states that the filaments of the fungus are verrucose; that in cultures they anastomose and produce sclerotia, and that upright hyphæ form outgrowths resembling conidia.

Mushroom Culture.‡—Josef Steinert has succeeded in growing mushrooms from spores. He sowed the spores on prepared manure; when the mycelium was evident it was transplanted to another hot-bed and kept at an equal temperature. Finally a good crop of mushrooms was raised.

Studies in Myxomycetes.§—E. Jahn continues his researches on this subject, and gives us his observations on spore germination. In the resting-spore of *Ceratiomyxa* he finds four nuclei; the amœba which issues from the spore on germination divides into 2, then 4 and 8 small bodies. In these latter the cilium is first formed and is connected with the nucleus. In all other Myxomycetes the spores are uninucleate and fall into two classes. In the first, the *Reticularia* type, the amœba remains for a short time in a resting stage and then forms a cilium. In the *Didymium* type the cilium is already formed within the spore-membrane. Jahn devotes special attention to the method of germination and to the immediate causes of the bursting of the spore-membrane. He found that he could hinder osmotic action in the spore and so retard germination by increasing the concentration of the culture fluid. He found also that the period of germination depends on the osmotic pressure of the surrounding fluid. High temperatures hastened the germination, especially of spores two years old. He verified Lister's experience that only after moistening and again drying can certain spores be induced to germinate. The bearing of these facts on the constitution of the protoplast is discussed by the author; he supposes that the germinating activity is induced by an enzyme that forms glycogen from maltose and which he terms glycogenose. The publication of further results is promised.

Aranzadi, D. Telesforo de—**Catalago de Hongos observados en Cataluna.** (List of fungi from Catalania.) **Lista de hongos del Empalme (Gerona) recibidos en Noviembre de 1905.** (List of fungi from Gerona received in November 1905.) **Segunda lista de nombres catalanes de hongos.** (Second list of Catalanian fungi.) *Bol. Hist. Nat.*, v. (1905) pp. 495–502.

* Klincksieck (Paris, 1905) xiv. and 145 pp., 64 col. pls.

† Comptes Rendus, cxli. (1905) pp. 836–8.

‡ Wiener Illustr. Gartenzeit., heft 7 (1905) pp. 230–2. See also Bot. Centralbl., ci. (1905) pp. 130–1.

§ Ber. Deutsch. Bot. Ges., xxiii. (1906) pp. 489–97.

BERNATSKY, E.—**Ueber die symbiose von Blutenpflanzen mit Pilzen.** (Symbiosis of flowering plants with fungi.)

[The author discusses the endotropic fungus of Orchids. He thinks it is probably an Ascomycete of the genus *Hypomyces*.]

Kertészeti Lapok, xx. (1905) p. 48 (with figs.). (Magyar.)
See also Hedwigia, Beibl., xlv. (1906) p. 88.

BOMMER, E., ET M. ROUSSEAU—**Champignons in "Resultats du voyage du S.Y. 'Belgica' en 1897–1899." Botanique.** (Fungi in the results of the voyage of the 'Belgica' in 1897–9.) Anvers, 1905, 15 pp. 4to, 5 pls.

BOUDIER—**Icones Mycologicæ. Série 1, livr. iv.–v.; série 2, livr. vi.**

[Further drawings, with explanations of plates. There are five new species described.] Klincksieck, Paris, 1905.

BUCHNER, ED., & ANTONI, W.—**Weitere Versuche über die zellfreie Gärung.** (Further research on free-cell fermentation.)

Zeitschr. physiol. Chem., xliv. (1905) pp. 206–28.
See also *Centralbl. Bakt.*, xv. (1906) p. 748.

COHN, E.—**Ueber eine seltene Schimmelpilzerkrankung des Menschen und ihren Erreger.** (A rare disease in Man caused by fungus.)

[The disease attacks the skin and internal organs. The fungus resembles a *Mucor* or *Chytridium*; probably it is a degenerate *Mucor*.]

SB. Niederrk. Ges. Nat. Heilk. Bonn, 1905, i. Hälfte B, Bogen 1–2, pp. 19–28 (7 figs.) See also *Bot. Centralbl.*, ci. (1906) p. 373.

FAIRMAN, CHARLES E.—**New or rare Pyrenomycetes from Western New York.**

[The species, many of them new, are a continuation of a list for Orleans County.] *Proc. Roch. Acad. Sci.*, iv. pp. 215–24 (3 pls.).

FELTGEN, JOHANN, & ERNEST FELTGEN—**Vorstudien zu einer Pilz Flora des Grossherzogthums Luxemburg.** (Preliminary study of the fungus flora of the Duchy of Luxembourg.)

[A list of fungi, which includes a number of new species.]

P. Worré-Mertens, Luxembourg (1905) 87 pp.

HENNINGS, P.—**Beitrag zur Pilzflora von Lanke. II.** (Contribution to the fungus-flora of Lanke.)

[Several new species are described.)

Abh. bot. Ver. Prov. Brandenburg, xlvii. (1905) pp. 211–22.
See also *Bot. Centralbl.*, ci. (1906) p. 257.

" " **Fungi Japonici. VI.**

[New species are described in most of the different groups of fungi, especially among the *Fungi imperfecti*.]

Engler's Bot. Jahrb., xxxvii. (1905) pp. 156–66.
See also *Bot. Centralbl.*, ci. (1906) pp. 257–8.

HUERGO, JOSÉ M.—**Enfermedades del trigo de 1904, en Entre Rios.** (Diseases of cereals in 1904 in Entre Rios.)

[Special attention is drawn to the ravages of bunt and rust.]

Bol. Minist. Agric., xi. (Buenos Aires, 1905) pp. 222–35.
See also *Bot. Centralbl.* ci. (1906) p. 214.

KAYSER, E.—**Les levures, caractères morphologiques et physiologiques, applications de levures selectionées.** (Yeasts, their morphological and physiological characters. Application of selected yeasts.)

[A general review of the work done on yeasts in late years.]

Paris: Gauthier, Villard, et Messon, ed. 2 (1905).
See also *Centralbl. Bakt.*, xv. (1906) pp. 747–8.

KLUGKIST, C. E.—**Discomyceten, Elaphomyceten, und Gasteromyceten aus Nordwestdeutschland.** (Descriptions and lists of fungi found in the neighbourhood of Hanover.) *Abh. Naturw. Ver. Bremen*, xviii. (1905) pp. 376–83.
See also *Bot. Centralbl.*, ci. (1906) pp. 289–90.

LEGER, L.—**Sur une nouvelle maladie myxosporidienne de la Truite indigène.** (A new myxosporidian malady of the indigenous trout.)
[The disease is caused by a species of *Chloromyxum*.]
Comptes Rendus, cxlii. (1906) pp. 655–6.

LONGYEAR, B.—**A Preliminary List of the Saprophytic fleshy Fungi known to occur in Michigan.** *Rep. Mich. Acad. Sci.* iv. (1904) pp. 113–24.
See also *Bot. Centralbl. Bakt.*, ci. (1906) pp. 214–15.

MAFFEI, L.—**Sopra una nuova specie di Ascomicete.** (On a new species of Ascomycete.)
[Diagnosis of *Sphærella ferulæ*.]
Atti Ist. Bot. Pavia, ser. ii. xi. (1905) 2 pp. (1 fig.).
See also *Bot. Centralbl.*, ci. (1906) p. 259.

MASSEE, G., & C. CROSSLAND—**New and rare British Fungi.**
[A list of six species new to Britain, or of very rare occurrence.]
Naturalist, No. 588 (1906) pp. 6–10 (3 figs.).

MASSEE, G.—**Additions to the Fungus Flora of Kew Gardens.**
[Five additional forms are described, three of which are new to science.]
Bull. Roy. Gard. Kew, No. 2 (1906) pp. 46–7 (1 pl.).

NOELLI, ALBERTO—**Contribuzione allo studio dei Micromiceti del Piemonte.** (Final contribution to the microfungi of Piedmont.)
Malpighia, xix. (1905) pp. 386–94.

REHM, H.—**Ascomycetes Americæ borealis.** (Ascomycetes of North America.)
[A number of new species are described.]
Ann. Mycol., iii. (1906) pp. 516–20.

ROTA-ROSSI, G.—**Due nuove specie di micromicete parassite.** (Two new species of parasitic micromycetes.)
[*Coniothyrium salicicolum* and *Phyllosticta mespilicola* are described.]
Atti Ist. Bot. Pavia, ser. ii. xi. (1905) 2 pp. (1 fig.).
See also *Bot. Centralbl.*, ci. (1906) p. 260.

" " **Prima contribuzione alla micologia della provincia di Bergamo.** (First contribution to the mycology of the province of Bergamo.)
[The list includes two new species.]
Op. cit., ix. (1905) p. 23. See also *Bot. Centralbl.*, ci. (1906) pp. 260–1.

SACCARDO, P. A.—**Notæ mycologicæ.**
(A list of the fungi Passeriniani and of Belgian fungi described along with M. Rousseau and E. Bommer. There is one new genus, *Pteromyces* (Discomycete).]
Ann. Mycol., iii. (1906) pp. 505–16.

Lichens.

(By A. LORRAIN SMITH.)

Anatomical Study of Ramalina.*—Theodor Brandt has examined and compared the thallus of all the European species of *Ramalina*. He finds that *R. thrausta* is really a species of *Alectoria*. The cortex is formed of sclerotic hyphæ, which run parallel, as in that genus, with the long axis of the thallus. *R. evernioides* has no mechanical tissue. All the other species of the genus possess sclerotic hyphæ which form a continuous ring round the thallus with projections towards the pith, or they occur in isolated groups. When the sclerotic tissue forms a ring it is broken through at intervals by the central tissue, thus forming breathing

* Hedwigia, xlv. (1906) pp. 124–58 (5 pls.).

pores in the thallus. Soredia are often formed at these points. The algæ occur in small clumps all round the thallus. Brandt studied the rhizoids in one species only: they were in the form of a rosette of sclerotic hyphæ. Calcium oxalate is present in a certain number of forms; in others it is wanting. A yellowish-green acid was demonstrated in all the species examined, probably usnin acid. In *R. scopulorum* and *R. subfarinacea* some colourless acid is found in the pith which becomes yellow and then rose-red on the application of potash.

Biological and Morphological Observations on Lichens.*—W. Zopf has taken advantage of the opportunity of seeing a large collection of lichens to make a series of notes. For the "group" species *Evernia furfuracea* he creates a new genus, *Pseudevernia*, with six morphologically and chemically distinct species. He finds difference of habitat and locality marking them off from each other, and he gives especially the differences between the two species *P. furfuracea* and *P. olivetorina*; the latter is a lichen found in the more mountainous localities, the former is an inhabitant of the plains. He refuses to accept Elenkin's finding that all the species are but forms of *Evernia furfuracea*.

Lichens of Kew Gardens.†—O. V. Darbishire has enumerated the few lichens—15 species in all—that have been found in Kew Gardens. The most frequent is an imperfect form, *Lepra viridis*. *Lecanora crenulata* is also frequently met with on limestone and building stones. *Cladonia* is best represented with five species.

American Lichens.‡—Bruce Fink continues the examination of Cladonias, and the present paper is devoted to a study of the species *cariosa*, distinguished by splittings in the stalk of the podetia which give it a latticed appearance. As a rule, Fink follows Wainio's classification, but in this case the Swedish lichenologist makes *cariosa* the representative of a compound species. Fink prefers definiteness, and selects var. *alpha cribosa*, of Wainio, as plainly the type of the species, it being by far the commonest. It is a Northern form, and is replaced in the Southern States by *C. miliaria*. Fink includes two varieties, *C. cariosa corticata* and *C. cariosa squamulosa*, and gives diagnoses and descriptions.

R. Heber Howe § chronicles the occurrence of *Ramalina rigida* in Rhode Island. It grows commonly on red cedar.

ELENKIN, A.—**Notes lichenologiques. VI.**
[On the absorption of organic substance by the lichen thallus and on the distribution of *Lecanora poliophæa*.]
Bull. Jard. Imp. Bot. St. Pétersbourg, v. (1905) pp. 121–33 (figs.).
See also *Hedwigia*, xlv. (1905) Beibl., p. 95.

KINDERMANN, VIKTOR, & RUDOLF BAAR—**Ein Kleiner Betrag zur Flechtenflora Böhmens.** (A small contribution to the Lichen Flora of Bohemia.)
SB. deutsch. Nat. Med. Ver. "Lotos" in Prag., xxv. No. 5 (1905) pp. 265–9.
See also *Hedwigia*, xlv. (1906) Beibl. p. 95.

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* Ber. Deutsch. Bot. Ges., xxiii. (1906) pp. 497–504 (1 pl.).
† Kew Bull. add., ser. v. (1906) pp. 102–3.
‡ Bryologist, ix. (1906) pp. 21–4 (1 fig.). § Tom. cit., p. 32.

Llenas y Fernandez, Don Manuel—**Algunos liquenos de los alrededores da Cuenca.** (Some lichens from Cuenca.)

[A list of lichens, many of them first records for Spain.]

Bol. Hist. Nat., v. (1905) pp. 508–11.

Zahlbruckner, A.—**Lichenes u. cl. Damazio in Brasilia lecti II.** (Lichens collected in Brazil by Damazio.)

[In this second publication 31 lichens are recorded with their habitat. Several new species and varieties are described.]

Bull. Herb. Boissier, ser. ii. v. (1905) pp. 539–43.
See also *Bot. Centralbl.*, ci. (1906) p. 317.

Zanfrognini, Carlo—**Note lichenologiche. 1. Sull Collema elveloideum degli autori.** (Lichenological Notes. 1. On *Collema elveloideum*.)

[The author discusses the synonymy of this and other species. and gives diagnoses of some lichens.]

Atti della Soc. Nat. Moderna, series 4, vii. (1905) pp. 84–92.
See also *Bot. Centralbl.*, ci. (1906) p. 131.

Schizophyta.

Schizomycetes.

Meningococcus.*—P. Vansteenberghe and Grysez, from a study of cerebro-spinal meningitis, find that the diplococcus isolated from the cerebro-spinal fluid of a typical case is very virulent for laboratory animals. When freshly obtained the organism stains well by Gram, but this property is under certain conditions not manifested, so that the authors consider that this reaction is useless for diagnostic purposes. By subdural inoculation of rabbits and guinea-pigs the microbe produces an affection with clinical and pathological symptoms identical with those of cerebro-spinal meningitis of man. The nerve tissue of animals dead from this disease is virulent and retains its virulence for months. The authors endeavoured to obtain the toxin from cultures of the organism, but without success, and they conclude that the toxin is contained within the bodies of the microbe. Reference is made to the morphological and cultural resemblances of this organism to the *Micrococcus catarrhalis* of Pfeifer, which, however, is virulent to subjects immune to cerebro-spinal meningitis, but when virulent it produces by subdural inoculation in laboratory animals, symptoms analogous to the meningococcus.

Streptococci and Diplococci on Blood Media.†—S. Boxer finds that, when cultivated on blood agar, streptococci cause a clearing of the medium, whereas diplococci produce a yellow coloration and the altered medium gives a distinct iron reaction. Though certain streptococci also produce a slight yellow colour, and certain diplococci also cause a slight clearing of the medium, a differentiation of individual streptococci according to their behaviour on blood media is not possible. The spectroscopic examination of blood bouillon inoculated with streptococci shows a change of the oxyhæmoglobin into neutral methæmoglobin. Blood bouillon with diplococci shows a green deposit on the sides of the tube. The hæmolytic action of streptococci and the yellow pigment formation of diplococci are independent of the amount and variety of the blood and of the temperature of the agar.

* Ann. Inst. Pasteur, xx. (1906) p. 69.
† Centralbl. Bakt. Orig., 1te Abt., xl. (1906) p. 591.

Paratyphoid Bacilli.*—E. Sacquepée and F. Chevrel find that the bacilli of the paratyphoid group are divisible into two subclasses, known as type A and type B. Both types possess many characters in common, but may be readily differentiated, especially by the results obtained by cultivating on metallic media (media to which salts of various metals have been added), on artichoke, and on vaccinated media. With stab cultures in gelatin to which has been added 1 : 20 to 1 : 30 of the double tartrate of iron and potassium, the bacilli of type B produce after 3–6 days a black coloration, whereas the bacilli of type A produce no change of colour; similar results occur with cultures on agar to which has been added 3·5 p.c. of subacetate of lead; with cultures on agar containing 1·5 p.c. of nitro-prussiate of soda the bacilli of type B produce within 2–5 days an intense green coloration, the bacilli of type A showing the same reaction but more slowly and less intensely. On artichoke the bacilli of type B colour the medium green within 2–3 days, those of type A produce the same effect only slowly or not at all. Vaccinated media were generally unfavourable to the development of the bacilli of both types; growth of the bacilli of type B is not hindered by cultures of bacilli of type A or of *B. typhosus*, but is hindered by cultures of *B. coli*.

Differentiation of Bacillus typhosus and Bacillus fæcalis alcaligenes.†—Piorkowski finds that the *B. fæcalis alcaligenes* may be differentiated from the *B. typhosus* by the appearance of its growth on urea gelatin, the colonies being larger and stellate and having a slimy appearance. The organisms grown on this medium show great differences in agglutinating reactions, and animals rendered immune against *B. fæcalis alcaligenes* are not protected from a virulent *B. typhosus*.

Tetanus Spores.‡—G. Tarozzi finds that in animals inoculated with sporing cultures of *B. tetani* the spores often pass into the circulation and are deposited in the organs, and that cultures of *B. tetani* may be obtained by planting portions of these organs in tubes of media. The spores remain latent in some organs for as long as 3½ months. The author considers that the return to activity of these collections of spores explains the production of those cases of obscure origin that go by the name of "rheumatic" or "spontaneous tetanus."

Diplococcus Iguanæ.§—E. Bertarelli has isolated a diplococcus which is pathogenic for the Iguana. The animal, *Iguana tuberculata*, was ill for two months; at the autopsy the liver was found covered with whitish nodules; there was fibrous adhesion of the liver to the parietal abdominal wall, but, with the exception of one lymph gland, the other organs were free from lesions. Cultivations were prepared on all media and placed at 27°, 30° and 37°, and portions were hardened for sections. The organism was isolated from culture from the liver and from the gland, but cultures from the blood and spleen gave negative results; the organism grows well at 30° C., but less well at 27° and 37° C., the temperature of the Iguana being 22°–25° C. On blood agar there is

* Ann. Inst. Pasteur, xx. (1906) p. 1.
† Centralbl. Bakt. Orig., 1te Abt., xl. (1906) p. 437.
‡ Tom. cit., p. 457. § Tom. cit., p. 458.

good growth after 24 hours; in broth it forms small crumbling flocculi that collect on the sides and at the bottom of the tube, the medium remaining clear; milk is not coagulated; there is no formation of indol; the cultures have but slight vitality. Morphologically it is a coccus, not staining by Gram, and not acid-fast; in first cultures it appears as a diplococcus resembling the gonococcus, but in late cultures tetrad forms occur, and some resembling the diplococcus of Weichselbaum, the 6–7 days old cultures showing many involution forms. Sections of the liver had the appearance of tuberculous lesions. Cultures inoculated into laboratory animals gave negative results. A tuberculous Iguana inoculated subcutaneously with 0·1 c.cm. of a fresh blood agar culture of the coccus, died with symptoms clinically and pathologically identical with those of the animal from which the organism was originally isolated.

Bacillus peptonificans causing an epidemic of gastro-enteritis.*—Lubenau gives an account of an epidemic of gastro-enteritis that occurred among the inmates of a sanatorium who had partaken of a dish of "Königsberger Klopsen" and which was apparently caused by a short stout bacillus that stained by Gram, and which morphologically bore certain resemblances to the hay bacillus. Growth appears on gelatin at 23° C. within 24 hours, the medium being liquefied; on agar at 37° C. there is good growth of separate grey colonies with broad iridescent margins, that run together, forming a moist white grey skin over the surface of the agar. Broth is clouded, but on the second day it clears, forming a grey pellicle, the bacilli showing active movement; in glucose broth there is no gas formation; litmus milk becomes intensely alkaline within three days, the milk remaining clear with the formation of a grey pellicle. Milk at first shows no change, but within a week there is a production of whey from the gradual digestion of the albumen, so that after two weeks clear whey remains above, and a deposit of sporulating bacilli at the bottom of the tube; the pepton formed in this process may be demonstrated by the Biuret reaction. Spore formation was observed in all media; the spores are oval, centrally placed, and very resistent, retaining their vitality after two hours' boiling. A hæmolysis is formed by the bacilli and passes over in the filtrate of the broth. Young dogs fed on milk infected with the organism developed symptoms of gastro-enteritis, and the bacillus was isolated from the fæces.

Action of Radium on Chromogenic Bacteria.†—C. Bouchard and Balthazar find that the emanations of radium do not modify the chromogenic properties of those bacteria, like *Micrococcus prodigiosus*, that secrete a colouring matter limited to the bacterial bodies, although if the dose is increased sufficiently the growth of the organism is arrested. With the other class of chromogenic bacteria, like *B. fluorescens* and *B. pyocyaneus*, producing pigment that is diffused into the culture medium, the chromogenic property is weakened by doses of the radium emanation much smaller than are needed to impair the vitality of the microbes. The authors note also, in respect of the action of radium emanations on *B. pyocyaneus*, that increasing doses not only diminish

* Centralbl. Bakt.. Orig. 1te Abt., xl. (1906) p. 433.
† Comptes Rendus, cxlii. (1906) p. 619.

the growth and virulence of the cultures, but produces morphological modifications, the rods becoming longer and in many cases curved; and that further increased doses have a true bactericidal action.

Bacterial Research on Gorgonzola Cheese.*—C. Gorini finds that the green and red patches seen in Gorgonzola cheese are due to the growth of a Hyphomycete belonging to the genus *Penicillium* and to a bacillus probably identical with *B. lactis erythrogenes* Hueppe. These organisms are introduced into the interior of the cheese as a result of artificial punctures, by means of which the manufacturer finds he is able to produce these characteristic marks.

Cultures of Bacillus typhosus, Bacillus coli, and some other allied bacteria on Drigalski-Conradi medium.†—Vourloud finds, from observations on the cultivation of various organisms on this medium, that *B. typhosus* forms round translucent blue colonies, the medium becoming greenish blue; with *B. typhi murium* the effect is similar, but the colonies are opaque; *B. coli* forms round red colonies, the medium being yellowish red; *B. dysenteriæ* (Shiga Kruse) forms small round colourless colonies, and the medium is uncoloured; *B. pestis* forms fine striated red colonies, the medium being yellowish-red; *B. pseudo-tuberculosis rodentium* forms round opaque colourless colonies, the medium being greenish blue; *B. pseudo-pestis* forms diffuse opaque colourless colonies, the medium being greenish blue.

Bacillus of "La Graisse," Disease of Wine.‡—E. Kayser and E. Manceau have isolated from three different kinds of ropy wine, a bacillus which forms chains of 2–8 links, 0·7 to 0·9 μ in breadth. The shape varies, however, with the medium; the growth ends by forming a sticky mass at the bottom of the liquid. It is an anaerobe, with an optimum temperature of about 30°. It requires sugar, particularly levulose, for its development, but other important factors are the presence of free acid, alcohol, nitrogenous organic substances, and potash salts.

Toxin and Antitoxin of Cholera.§—Brau and Denier find that cholera toxin when injected subcutaneously and intravenously imparts an immunity, the serum of the vaccinated animals acquiring an antitoxic power. A still more powerful serum is obtained by means of intravenous injection of living cultures. The authors conclude that there is a close similarity between the cholera toxin, formed in albuminous media, and those of plague and typhoid, and express the opinion that no distinction can be drawn between the toxin existing within the body of the microbes and that in the culture medium.

Bacteria of Mosca olearia.‖—L. Petri, from some further researches on *Ascobacterium luteum*,¶ finds that the bacteria are not entirely expelled from the intestine of the larva, but remain in an œsophageal

* Atti R. Accad. Lincei, xv. (1906) p. 298.
† Centralbl. Bakt., 1te Abt. Orig., xl. (1906) p. 754.
‡ Comptes Rendus, cxlii. (1906) pp. 725–7.
§ Tom. cit., pp. 728–9.
‖ Atti R. Accad. Lincei, xv. (1906) pp. 238–46 (2 figs.).
¶ See this Journal, 1905, p. 483.

diverticulum till the later nymphal stages. Here they maturate, afterwards migrating to the intestine of the adult insect, even when kept devoid of food. Cultivations in artificial media from the insect in any stage of development was found to be almost impossible, owing to some special conditions. The passage from this special condition to one purely saprophytic appears to be due to changes in the nutrition of the fly, rendering the intestine more favourable to the development of the bacteria. In the larva this passage constantly takes place. Larvæ which develop from eggs laid in sterilised olives, by flies born and bred in a sterile environment, are found to have bacteria in their alimentary canal.

Action of Tuberculin.*—The observations of A. Calmette and his associates show that the infection of goats and guinea-pigs *per os* passes to the lungs, and often without leaving any trace of a lesion in the abdomen. The injection of guinea-pigs with tubercle, dried and heated to 100°, causes symptoms identical with those of repeated small doses of tuberculin, whether the animals are already tuberculous or not.

Tuberculin absorbed by the alimentary canal is toxic for non-tuberculous animals, especially if young. Tolerance is never imparted by increasing doses. Guinea-pigs rendered tuberculous by a single feed (0·02 grm.) always react to tuberculin (1 mg.), a harmless dose to healthy animals. The reaction is obtained equally well by ingestion and by subcutaneous injection.

Composition of the Tubercle Bacillus.† — G. Baudran gives the following analysis of the tubercle bacillus :—

Fatty matters—		
Cholesterin	5–7	36–44
Stearin	15–18	
Olein	10–12	
Distearic lecithin	6–7	
Nuclein		3–4
Cellulose		3·6–5·5
Iron		0·006–0·008
Manganese		traces
Albuminoid substances		50–56

Acid-fast Bacilli and Tuberculosis.‡—A. Borgeaud has met with two instances of a rare form of tuberculosis which possibly forms a connecting link between the pathogenic and non-pathogenic forms of acid-fast bacilli. The affection presented itself as a hypertrophic enteritis, the wall of the intestine being 4–5 times thicker than normal. There was no ulceration. In the sections of the intestines and adjacent lymphatic glands no giant cells were found ; from a histological point of view there was no evidence of tuberculosis. Yet in the affected parts were myriads of bacilli morphologically and tinctorially identical with

* Ann. Inst. Pasteur, 1905. See also Comptes Rendus, cxlii. (1906) pp. 441, 616.
† Comptes Rendus, cxlii. (1906) pp. 657–9.
‡ Bull. Soc. Vaudoise Sci. Nat., xli. (1905) pp. 281–7.

the tubercle bacillus. Cultivations were unsuccessful, but inoculations on rabbits and guinea-pigs produced a tuberculosis chiefly local in character, with tendency to resolution and of a low degree of intensity. The author considers that this variety should be placed between the paratuberculous bacillus and the bacillus of avian tuberculosis.

New Photobacterium.*—T. Imamura cultivated from a species of *Pleuronectus* an oval flagellate Photobacterium, which was easily stainable, but not by Gram's method. It grew on all ordinary media, but best on egg albumen moistened with saturated salt solution, or upon 10 p.c. gelatin with 3 p.c. salt. The light developed appeared to be dependent on the amount of salt, but indifferent to the presence or absence of oxygen. The colonies could be photographed by their own light, which was also sufficient for observing the individual bacterial cells under the Microscope.

* Nippon Eiseigakki Zasshi, i. (1904) p. 48. See also Centralbl. Bakt., Ref. 1te Abt., xxxviii. (1906) p. 37.

MICROSCOPY.

A. Instruments, Accessories, &c.*

(1) Stands.

Reichert's Dissecting Microscopes, with Handle.†—In fig. 42 is shown a simple dissecting Microscope with handle and sliding adjust-

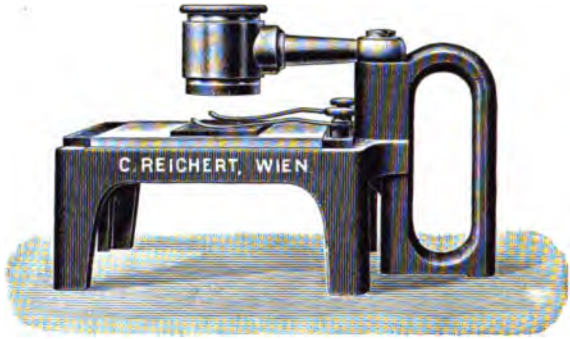

FIG. 42.

ment. A more elaborate variant is shown in fig. 43. This form has rack-and-pinion adjustment, the large stage and foot being made of

FIG. 43.

* This subdivision contains (1) Stands; (2) Eye-pieces and Objectives; (3) Illuminating and other Apparatus; (4) Photomicrography; (5) Microscopical Optics and Manipulation; (6) Miscellaneous.

† Special Catalogue, 1905–6, p. 13.

brass. The mirror is flat, with lateral displacement. The hand supports are covered with leather. This model can be supplied with a glass cover to the stage, and a laterally movable arm for the lamp-holder.

A New Construction of the Preparation Microscope.*—F. K. Studnička shows how the usual Microscope-stage can be used with the preparation Microscope described in a previous abstract.† A reversed achromatic objective (Reichert's No. 2) is screwed on to a thread as near

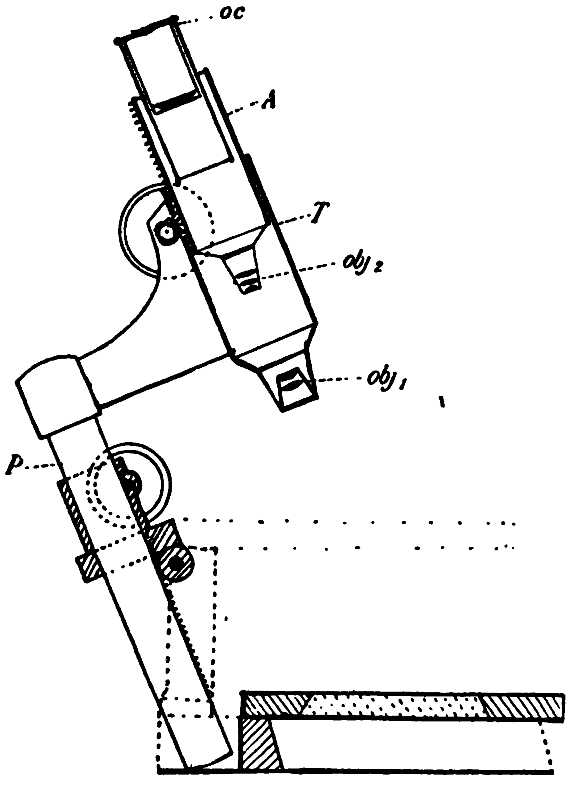

Fig. 44.

the bottom end of the tube as possible. The ordinary objective, which is intended for the magnification of the reversed image of the object, is fastened to the lower end of the draw-out tube. The ocular is placed as usual. The whole arrangement is thus combined and can be focused by rack-and-pinion. The application of the instrument is, however, controlled by the limits within which the rack-and-pinion admit the tube movements. In using weak magnifications the working distances

* SB. k. Böhm. Gesell. der Wiss., 1905 (v.) 4 pp., 1 fig.).
† See this Journal, 1905, p. 643.

of the lenses are not convenient for ordinary stands, and the author, therefore, proposes the modified design shown in fig. 44. The tube T is provided with a sufficiently long draw-out tube A, worked by rack-and-pinion. At the lower end of the whole tube is the reversed objective (*obj.* 1) and at the lower end of the draw-out the ordinary objective (*obj.* 2). The draw-out must be of such a length that the objective at its lower end, when the tube is completely inserted, does not reach the reversed objective. A further distinction from an ordinary stand is in the action of the prismatic bar P which, by rack-and-pinion, may be raised so as to bring the body to a greater height above the stage. The attainment of this increased working space is also effected by making the object stage adjustable in level.

Brunnee's Polarisation-Microscope-Polymmeter.*—This instrument of R. Brunnee's is distinguished from an ordinary mineralogical Microscope only by the kind of fine-adjustment used. The micrometer-screw is actuated by means of a drum applied to the tube, and in the drum is a circular wedge of weak obliquity. The fine-adjustment of the objective is attained through the sliding of a bar, connected with the objective, along this wedge, so that a simultaneous rotation of the objective takes place about the axis of the instrument during the fine-adjustment. This mechanism facilitates at the same time a rotation of the inner Nicol, which rotation is independent of the polariser, but can also engage with it by means of a toothed wheel over-movement.

RINNE, F.—**Le Microscope polarisant, trad. par L. Pervinguière, avec préface par A. de Lapparent.** Paris, 1904, 160 pp.

(2) Eye-pieces and Objectives.

New Form of Ehrlich Eye-piece for Counting Blood-corpuscles.—This apparatus, made by R. & J. Beck (fig. 45), is a Huyghenian eye-piece of the No. 1 R.M.S. standard size. It fits this firm's "London" Microscopes and those of Continental makers. It is provided with an adjustable square aperture, the size of which can be varied from 1 mm. to 8 mm, so that it can be easily set for any desired size.

The actual area to which the size in use corresponds with any particular object-glass can be ascertained by slipping a stage micrometer on the stage of the Microscope.

FIG. 45.

Magnifying Power of Microscopical Objectives.†—L. Malassez points out that there is no precise definition of the phrase "magnifying power." He suggests that it would be advantageous to express the magnifying effect of a lens in terms of unit distance from its posterior face, and that the term "magnifying power" could be conveniently

* Zentralbl. Min. Geol. Paläont., 1905, pp. 593–5 (1 fig.). See also Zeitschr. wiss. Mikrosk., xxii. (1905) pp. 586–7.
† Comptes Rendus, cxli. (1905) pp. 880–1.

restricted to this application. The term "power" should be reserved for the magnification produced at unit distance from the posterior focus and at each successive unit. This unit distance should be in each case the metre, or better, the decimetre, which corresponds more closely to ordinary microscopical working distances.

In a subsequent paper * the author discusses the methods of evaluating the magnifying power.

1. By direct measurement with a micrometer objective and a micrometer ocular, the latter being placed exactly at unit distances. The full details he has explained elsewhere.† The sole inconvenience is that a specially made tube is necessary, a decimetre tube not being of ordinary make.

2. By means ‡ of graphical curves a relation may be expressed between the power and the distance between the posterior face and the posterior focus. This method readily gives the magnifying power.

3. By calculation from the formulæ $P = (1 - \phi'_p)\gamma$, or $P = (1 + \phi'_a)\gamma$, when P = the magnifying power; γ, the power; ϕ'_a, ϕ'_p, the distance from the posterior face of lens to its posterior focus, according as the posterior focus is on the anterior or posterior side.

Evaluation of the Power of Microscope Objectives.§—L. Malassez gives three methods by which observers may determine powers for themselves in his proposed notation.‖

1. Let G be the magnification produced at a distance D, g that at a less distance d, and γ the power (i.e. the magnification produced at unit distance), then

$$\gamma = \frac{G - g}{D - d}.$$

In selecting the distances the tube should be completely extended for D and completely depressed for d.

2. Let g be the magnification produced by the objective at a distance d' from its posterior face and ϕ' its foco-facial posterior distance (i.e. the distance between its focus and posterior face), then

$$\gamma = \frac{g}{d' - \phi'} \quad \text{and} \quad \gamma = \frac{g}{d' + \phi'};$$

the first formula being applicable when the posterior focus of the objective is behind the posterior face; the second, when it is in front of it, which happens when the objectives are somewhat strong.

If the magnifying power P be defined as on a previous occasion,¶ these formulæ become

$$\gamma = \frac{P}{1 - \phi'_p}, \quad \gamma = \frac{P}{1 + \phi'_a}.$$

* Comptes Rendus, cxli. (1905) pp. 1004–6.

† Archives d'Anatomie Micr., 1904, pp. 274, 285. See also this Journal, 1905, p. 500.

‡ Tom. cit., p. 298. See also this Journal, 1905, p. 500.

§ Comptes Rendus, cxlii. (1906) pp. 773–5.

‖ Soc. de Biologie, viii. (July 15 and Dec. 10, 1904). See also Archives d'Anatomie Micr., 1904, p. 270; and this Journal, 1905, p. 500.

¶ Comptes Rendus, Nov. 27 and Dec. 11, 1904. See also this Journal, 1905, p. 500.

3. Lastly, as the power is also the enlargement produced at unit distance from the posterior focus of the objective, it can be evaluated directly by determining the position of this posterior focus (i.e. the foco-facial posterior distance), then by measuring the enlargement produced at a decimetre further, or at any other unit of distance.

The author gives a sample table of results obtained with a certain number of objectives of different strengths.

Cheap Glass Lenses.*—A cheap and simple way of obtaining large lenses suitable for photographic and such-like work, is to form a combination of ordinary watch, or clock glasses, with water or other suitable liquid. Two glasses, whose edges must be well ground so as to fit well when placed in contact, are dipped into the liquid and removed, filled with it, as a whole. The edges are then wiped dry, and moistened with water-glass, which, helped with a little hydrochloric acid, sets quite hard, so that the "lens" can be freely handled. This process is assisted by the use of a peculiar brush, having two pencils on one shaft. As this brush is passed round the periphery, the front pencil wipes off the superfluous fluid, and the following pencil applies the water-glass. By means of a glass disk and a watch-glass, a plano-convex lens can be made, and several other forms are possible.

BERGER, E.—**Ueber das bei meiner binokularen Lupe verwendete Linsen-system.**
Deutsche Mech. Zeit., 1905, p. 155.

BRASS, A.—**Die Linsenfassungen.**
[Discusses several errors sometimes made in lens-mounts, and emphasises the necessity of lamp-blacking their inner surfaces.] *Central. Zeit. Opt. Mech.*, xxvii. (1906) pp. 15–17 (10 figs.)

" " **Die Zusammensetzung von Linsensystemen.**
[A popular explanation of certain principles.]
Tom. cit., Nos. 4–7, pp. 31–3 (2 figs.).

(3) Illuminating and other Apparatus.

A New Application of the Abbe Condenser.†—F. K. Studnička reminds his readers that the Abbe condenser presents a real, reversed image of the source of illumination. If an object, such as a micrometer scale, be suitably interposed, an image of this will be similarly formed on the stage, and may be applied to measuring an object there. In this way, by the help of a proportionately stronger objective, a series of magnifications can be obtained which are very convenient for drawing, and for the preparation of various objects. The size of the image formed above the front-lens (viewed from above) of the condenser depends on the distance of the object from the under-lens; the image is smaller as the distance is increased. Thus it will be seen that the series of magnified images thrown on to the stage will vary from zero to a maximum. This image can be combined with various powers of objective, eye-piece and tube-length, and thus the series of attainable effects is practically infinite—although only observations in the middle of the field will be free from sensible distortion. Instead of the condenser, weak achromatic objectives might be used. A difficulty would,

* Central. Zeit. f. Opt. u. Mech., xxvi. (1905) pp. 261–2.
† SB. k. Böhm. Gesell. der Wiss., 1905 (iv.) 4 pp.

no doubt, lie in the construction of a suitable adjustable stage for the object; the author, however, sees his way to a proper design. He summarises the advantages of this proposal as :—

1. The facility for orientating objects which can be afterwards examined in the usual way.

2. The formation of graduated magnifications by which an operator who wishes to draw from a weak magnification can easily select the most suitable power.

3. The property possessed by the Abbe (thus used) in combination with an objective of forming an *erect* image.

4. If a plane mirror be used, and the object inserted between the light-source and the mirror, an erect Microscope becomes virtually a horizontal one, and may thus be used, for example, as an aquarium microscope.

5. As the magnification may be zero, the arrangement may be applied to the drawing of objects in their natural size.

Post-Objective Stop.* —At the March Meeting, J. W. Gordon exhibited a new form of post-objective stop for the Microscope, an illustration of which is now given (fig. 46), together with a description of the various parts.

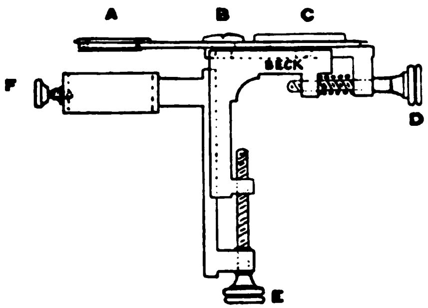

FIG. 46.

A. Cell carrying the mercury globule which forms the stop.
B. Pivot on which the cell-carrying arm swings.
C. Excentric for swinging the arm, and so giving a transverse traversing adjustment to the stop.
D. Propelling screw for giving a longitudinal traversing motion to the pivot B and so to the stop.
E. Supporting screw for adjusting the height of the swinging arm and of the stop carried by it.
F. Mounting ring, provided with a set screw, for clamping the fitting to the draw-tube of the Microscope.

Use of the Cooper-Hewitt Lamp as a Source of Monochromatic Light.†—C. Fabry and H. Buisson warmly recommend this lamp, which is on the principle of an electric arc in mercury vapour. Its spectrum resembles that of the older mercury vapour lamps. The light is fixed,

* See this Journal, 1906, pp. 157–60.
† Comptes Rendus, cxlii. pp. 784–5.

and of uniform intrinsic luminosity. The yellow and green rays are fine enough to give interferences observable to a difference in step of 22 cm.—i.e. in the neighbourhood of the number of order 400,000. The old form of mercury arc (Perot-Fabry model) gives almost the same result immediately after lighting. But, after a few minutes' action, probably in consequence of vapour-heating, the rays widen out, and the limit of interference falls almost to half of its primitive value. In the Cooper-Hewitt, on the contrary, the first state is indefinitely maintained. The yellow rays give especially clean interferences, and the phenomena of disparition, or of successive doubling when the two rays are simultaneously employed, are observable to very great differences of step. The fact that the lamp is constructed for industrial purposes is found to be an advantage.

DAVIS, D. J. A.—**A Method of Microscopic Observation by means of Lateral Illumination.** *Trans. Chicago Pathol. Soc.*, vi. (1904) p. 90.

GREIL.—**Beleuchtungsapparate mit Nernstchem Glühlicht.** *Anat. Anzeig.*, *Ergänzungsh.*, xxv. (1904) p. 178.

KALÄHNE, A.—**Ueber das Woodsche Lichtfilter für ultraviolette Strahlen.** *Phys. Zeitschr.* v. (1904) p. 415.

PLÜGER, A.—**Die Quecksilberlampe als ultraviolette Lichtquelle.** *Tom. cit.*, p. 414.

ANON.—**Vorrichtung zum Wechseln der Bilder im Projektionsapparat.** *Deutsche Mechan. Zeit.*, 1905, p. 127.

(5) Microscopical Optics and Manipulation.

Ultramicroscopy of Oleosole.*—J. Schneider and J. Just have been investigating the appearances presented, when viewed by ultramicroscopic methods, by finely divided particles of gold and other noble metals in a viscous, yet completely homogeneous, transparent, and combustible fluid. For this purpose fats and ethereal oils were treated with chlorides of the metals, and the products of reaction ultramicroscopically studied. The authors summarise their conclusions as follows:—

1. The ultramicroscope is adapted to the determination of the identity and purity of oils and to the testing of oil-mixtures.

2. The oils are tested with the ultramicroscope after they have been surrounded with oleosole of the noble metals by means of their reactions with compounds of the latter.

3. In the ultramicroscopic study observation was made of the points and groups sparsely aggregated in the whole cone; the determination of the diameter of the interference rings produced by any slight alteration of the fine-adjustment; the especial examination of ringless or ringed points and groups, with and without the analyser.

4. In the examinations made of commercial oils the various forms assumed by the fat, as distinct from the oil, under the ultramicroscope were a distinct hindrance to the observation of the metal particles; the use of ultramicroscopes with heating arrangements were necessary for further work.

5. The effect of the reaction is affected by many circumstances,

* Zeitschr. wiss. Mikrosk., xxii. (1905) pp. 481-530.

especially by the solution-medium, temperature, movement, time, and quantity of oil. Light-influence was only observed in the case of silver.

6. The best results were obtained in the ultramicroscopical tests of oils after reaction with gold chloride. In the case of amicroscopic particles there was a reddening; a blue colouring resulted with sub-microscopic and microscopic particles, combining into a blue-black precipitate; a yellow coloration followed with other submicroscopic and microscopic particles, which combined into a shimmering and gleaming golden mass. One form only, or two, or all three together can be met with.

7. From silver solutions either amicroscopic particles precipitated, causing a blue colour of the cone, or submicroscopic and microscpic particles. With the silver reduction, moreover, the reaction with the sulphur contained in many oils gives cone-coloration by reason of the amicroscopic particles.

8. In reactions with ruthenium chloride the result is either a yellow or a red cone-colouring with the amicroscopic particles, or the sub-microscopic and microscopic particles segregate themselves.

9. Tests with osmic acid and with platinum chloride gave no practically useful results, and other more favourable conditions for reaction and test are to be sought.

10. The desired connection of the ultramicroscopical condition with a property expressible in figures or a quantitative reaction was not found, and the question, how fine is the emulsion of which an oil is capable with a given reagent under existing conditions, still remains open.

A Simple Method for the Determination of the Refraction-Index of Liquids.*—A. Pauly shows how this quantity can be found without costly apparatus and from a small quantity of fluid. The equation on which the calculation is based is:

$$n = \frac{w\xi}{\sqrt{\xi^2 \sin^2 V + w^2 \cos^2 V}}$$

where w and ξ are respectively the major and minor semi-axes of the ellipsoid of rotation, n the refractive index, and V the angle between the radius vector and the major axis. In calcite the principal refractive indices (with sodium light, w_{na}) are $w_{na} = 1 \cdot 6585$, $\xi_{na} = 1 \cdot 4864$; all indices between these values lie on the ellipse. If then a section be taken parallel to the principal axis, all intermediate indices can be calculated if the angle of inclination of the ray be determined. A drop of the fluid under investigation is placed on the calcspar plate and under a coverglass. The polariser is then applied to determine the angle of rotation. The ray through the Nicol now passes in a known direction, and only the refractive index parallel to this direction is effective, and, as the fluid is isotropic, it is the same in all directions. The object-stage with this preparation is rotated until the inequalities of the upper plane or the limits of the periphery disappear. Let A be the angle read off on the circumference of the object-stage at the disappearance of the inequalities, and let B be the reading when the inequalities again dis-

* Zeitschr. wiss. Mikrosk., xxii. (1905) pp. 344–8 (1 fig.).

appear after continued rotation. Then $V = \frac{1}{2}(A - B)$ is the angle which the desired refractive index forms with the principal index. The index can also be found graphically when a series of determinations has been made. In this case a curve is drawn whose horizontal co-ordinates give n at intervals from 0·01–0·01, and the vertical co-ordinates give the angle V at intervals of 10°. Intermediate values would be read off in the usual way. The author gives some tables of results.

Microscopical Axial-angle Determination of very small Crystals.* E. Sommerfeldt, after describing some of the methods bearing on this subject, recommends as a simple mode the insertion of a scale in a suitable place under the object-stage and parallel to it. This should be used with Lasaulx method, and then both images and scale are well defined. The firm of Fuess has, at the author's suggestion, connected this scale with a condenser, which consists of three plano-convex lenses, the lowest of which carries the scale on its plane-face. The condenser is so calculated that a scale thus placed is sharply defined in the axial image.

Ultramicroscopical Investigations upon the Colours of Rock Salt.†—H. Siedentopf points out (1) that it is possible to colorise perfectly colourless specimens of rock salt by a process of heating in a vacuum tube in the presence of sodium or potassium vapour (Heraens), and (2) that it is possible by a process of ionisation to affect the colour of a coloured specimen, or impart a tint to a colourless one (Goldstein, Becquerel, Holzknecht, and others). This latter process, however, only seems to produce a surface effect. Siedentopf adopts the method of Heraens by which six or eight rectangular prisms of perfectly clear and clean rock salt, about 10 by 5 by 3 mm., were placed in a completely vacuous combustion tube, and heated for some time to 600° C., so as to render the crystal entirely water-free. By means of a distillation tube consisting of several bulbs united by capillaries, sodium or potassium was distilled over into the presence of the heated rock salt until about a cubic centimetre, with a bright gleaming surface, was adjacent to the crystals. Special care was taken that the surfaces of the crystals should not be soiled with alkali vapour. The evacuation was once more performed, hydrogen at reduced pressure introduced, and the special preparation tube melted off. Fig. 47 shows this preparation tube as supplied by Carl Zeiss.‡ Its use will be readily understood from the foregoing. The heating is most conveniently done in one of Heraens' vertical electric furnaces, which should be maintained at a constant temperature of about 50–80° below the boiling point of the alkali-metal. This would be about 680° C. in the case of sodium, and about 590° C. for potassium. This temperature is an optimum, for, at a lower temperature, too little alkali vapour would be produced, and, at a higher

* Zeitschr. wiss. Mikrosk., xxii. (1905) pp. 356–62 (4 figs.).

† Ultramikroskopisch Untersuchungen über Steinsalzfärbungen. Verhand. der Deutschen Physikal. Gesell., vii., No. 1421 (1905); also as a separate tract under above title. Braunschweig, Vieweg & Sohn.

‡ Special circular, Präparatenröhre zur Herstellung optischer Resonatoren aus metallischen Natrium im Steinsalzkristallen.

temperature, the alkali vapour re-distils out of the salt whereby the crystal is decolorised. The temperature is also limited by the melting point of the salt (about 800°), and by the bending temperature of the combustion tube (about 700°). After the heating the preparation tube is taken out of the furnace and allowed to cool in a vertical position in order to avoid external smearing of the coloured crystals with alkali vapour. The excess of alkali settles down in the trough-shaped bottom of the tube. After cooling, the tube is carefully snapped off, without breaking the crystals, which are then rapidly rinsed with water and dilute hydrochloric acid and then dried. For microscopic examination, the preparation is then ready; but for ultramicroscopic investigation they must, on two adjacent surfaces, be polished as carefully as possible free from scratches and the polished surfaces made permanent by means of cover-glasses cemented on.

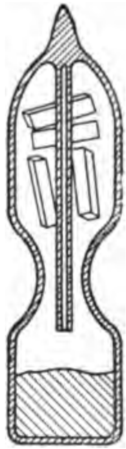

FIG. 47.

The ultramicroscopical examination is performed by the usual apparatus, and Siedentopf concludes that rock salt coloration is essentially due to separation of ultramicroscopic metallic sodium crystalline particles, mostly needle- or flat-shaped, and partly pleochroitic, which are irregularly distributed within the ultramicroscopic cleavage planes and which vary from cubic centimetre to cubic centimetre of the crystal.

He gives his reasons in full for his conclusions, rejects the hypothesis of sub-chloride formations, and refers to the phenomenon of electric resonance previously noted by W. Wood.*

The author adds a coloured plate comparing the results of artificial and natural colorisation as furnished by his ultramicroscopical analysis.

Some Simple Questions on the Images of Microscopes and Telescopes.†—At a recent meeting of the Physical Society, W. B. Croft stated that: "It may have been noticed that when a Microscope is focused visually, an image is formed on the focusing-glass of a camera, into which the microscopic eye-piece is inserted after removing the camera-lens. This image remains more or less in focus at variable positions of the camera-screen. Although it is not always perhaps true, yet it is surprising how often the pencil emerging from a Microscope eye-piece behaves like a single concentrated line of light. A mounting of the proboscis of a fly was focused visually, then a camera was put on the end of the Microscope, and the screen was racked out to six positions over a range of about 6 in. At these positions six photographs were taken, of which the two smallest pictures were inferior to the others. It was claimed that this defect was due to imperfect exposure and uneven illumination. If the visual focusing had made pencils slightly diverging instead of parallel, the larger pictures should have been the more imperfect. These pictures were obtained with a 1-in. objective.

* Phil Mag. (6) iii. (1902) p. 396.

† Proc. Phys. Soc. London, April 27, 1906.

Next, a diatom, *Triceratium favus*, was photographed with a $\frac{1}{4}$-in.-objective. With a visual focusing two photographs at different distances were taken; these were similar to one another and to what was seen. The same diatom then had a slightly different visual focusing, with the same result as before in the two pictures. Finally, two diatoms with fine markings were focused visually and at two positions; the markings came out clearly in the photograph. The object of showing the results was not to make out that the emergent pencil was ever actually, or always approximately, a single line of light, but to intimate how often the author had found, when projecting from an optical eye-piece, that no change can be detected in the definition of the image as the screen of the camera is moved. If a camera-lucida is placed on the eye-piece, the image of a stage-micrometer can be thrown on a scale at 10 in. distance or at 40 in. distance. The parallel rays emerging from the eye-piece give the image of a point along a direction, at no definite position. The image can be imagined at 40 in. distance as easily as 10 in."

Mr. Croft also showed some photographs taken from sections of the human eye; he indicated that a divergent pencil from a small aperture or from a convex reflecting surface of large curvature will give the Purkinje figures as bright radiating lines, whereas the usual method of sending light through the side of the sclerotic gives them as shadows.

BRASS, A.—**Grundesetze der Optik.**
[This treatise is continued and concluded.]
Central. Zeit. Opt. Mech., xxvi. Nos. 20–4 (Oct. 15 to Dec. 15, 1905).

KERBER, A.—**Zur Theorie der schiefer Büschel (Zweiter Beitrag).**
Zeit. f. Instrumentenk., xxv. (1905) pp. 342–3.

MEYER—**Das Ultramikroskop.** Band i., No. 1.

PEYTZ, K.—**Mikroskopische Bestimmung der Lage einer spiegelnden Fläche.**
[The principle of this method is optical contact. It was noticed in this Journal for 1905, p. 756.]
Tom. cit., pp. 386–7. See also *Ann. d. Physik*, xvi. (1905) p. 735.

WILSING, J.—**Ueber die Zweckmässigste Wahl der Strahlen gleicher Brennweite bei Achromatischen Objektiven.**
[Discusses the theory of complete achromatism, and describes several kinds of glass whose constants would lend themselves to such a result.]
Tom. cit., pp. 41–8.

(6) Miscellaneous.

Quekett Microscopical Club.—At the 430th ordinary meeting of the Club, held on April 20, Mr. F. P. Smith brought forward two papers —"On the Spiders of the *Diplocephalus* Group" and "A Catalogue of the Literature dealing with Erigonine Spiders." A paper on "Stereo-photomicrography" was read by Mr. H. Taverner, F.R.M.S., and a paper on the same subject which had been communicated by Mr. W. P. Dollman, of Adelaide. Mr. J. Rheinberg, F.R.M.S., gave a résumé of a long and technical paper on "Stereoscopic Effect and a suggested improvement in the Binocular Microscope."

At the 431st ordinary meeting, held on May 18, Mr. A. E. Smith gave an account of the three methods he employed in stereo-photomicrography, and Mr. D. J. Scourfield, F.R.M.S., greatly interested the

meeting with his lecture on "Mendelism and its connection with Microscopy." Attention was drawn to the modification in current views on variation, the origin of species, etc., which seemed to follow an acceptance of Mendel's law.

Microscopy of Vegetable Foods.*—In collaboration with Josef Moeller, Andrew L. Winton has brought out what is probably the first work in an English dress which deals exclusively with the microscopy of vegetable foods. It has special reference to the detection of adulteration and the diagnosis of mixtures, and has been designed for the use of the food analyst, the agricultural chemist, the pharmacist, and others engaged in the examination of foods, as well as the physician who may be called upon to identify vegetable substances in stomach contents and fæces.

The work is divided into 10 parts, which deal with: (1) Equipment methods and general principles; (2) grain, its products and impurities; (3) oilseeds and oilcakes; (4) legumes; (5) nuts; (6) fruit and fruit products; (7) vegetables; (8) alkaloidal products and their substitutes; (9) spices and condiments; (10) commercial starches. At the end is a useful glossary; the bibliography is copious, and is both general and special. The volume is excellently got up; it is profusely illustrated.

The work has evidently been prepared with great care, and the names of the authors are sufficient guarantee for the contents.

MICHAELIS, L.—**Ultramikroskopische Untersuchungen.**
[This is an abstract of the author's article in Virchow's Arch., clxxix. (1905) heft 2, pp. 195–208, 1 pl.]
Zeitschr. wiss. Mikr., xxii. (Dec. 1905) p. 428.

ZSIGMONDY, R.—**Zur Erkenntnis der Kolloïde. Ueber irreversible Hydrosole und Ultramikroscopie.** Jena: G. Fischer (1905) 8vo, vi. and 186 pp., 6 figs. and 4 pls.

ZETZSCHE, F.—**Das Mikroskop, seine Entwickelungsgeschichte. Mit Faksimile-portrait Lieuwenhoeks und Zahlreichen Textabbildungen.**
Kötzschenbroda and Leipzig: Thalwitzer.

B. Technique.†

(1) Collecting Objects, including Culture Processes.

Collecting Rotifera.‡—P. de Beauchamp recommends the following method and procedure for the wholesale preservation of Rotifera for study of the fauna of a lake or district, or for making collections when travelling in new or distant countries, when an examination on the spot is impracticable. After collecting the small plankton in the usual way, he places the condensed material in a bottle, and allows it to stand for half an hour or an hour, at the same time subjecting it to a one-sided illumination. As a result of this, all large floating debris will settle at the bottom, while the Rotifera will mostly congregate in the illuminated portion near the top of the water, where they can be seen with the naked eye like a white cloud. From this region a tube full of

* New York: John Wiley and Sons. London: Chapman and Hall, Ltd., 1906, xvi. and 701 pp., 589 figs.

† This subdivision contains (1) Collecting Objects, including Culture Processes; (2) Preparing Objects; (3) Cutting, including Imbedding and Microtomes; (4) Staining and Injecting; (5) Mounting, including slides, preservative fluids, &c.; (6) Miscellaneous.

‡ Arch. Zool. Expér., Notes et Revue, iv. (1906) pp. xxvii.–xxxiii.

water with the animals is removed by means of a pipette, and treated as follows :—1 drop of the narcotising fluid, consisting of hydrochlorate of cocaine 1 grm., methyl-alcohol 10 c.cm. Distilled water 10 c.cm. is added at intervals of five minutes and mixed, until it is seen that most of the rotifers have fallen to the bottom of the tube. Then they are immediately killed and fixed by adding as many drops of 1 p.c. osmic as the tube contains c.cm. of fluid, and mixed. After ten minutes the animals are removed with a pipette and washed in 1 or 2 p.c. commercial formalin, and finally preserved in the same fluid. The non-pelagic rotifers, creeping and living upon aquatic plants, are obtained by placing a quantity of the plants in a large jar or bucket with just enough water to cover them, and leaving them there for several hours. Asphyxiation will soon drive the animals to the surface film and near the light, where they are collected and treated as before. The author considers that this method, which in its main features is that of Rousselet, will preserve a large number of rotifers in a fairly extended condition, and suitable for systematic study.

Cultivation of Anaerobic Organisms applicable to Water Analysis.* A. Guillemard employs the following method (fig. 48) : a large Pasteur

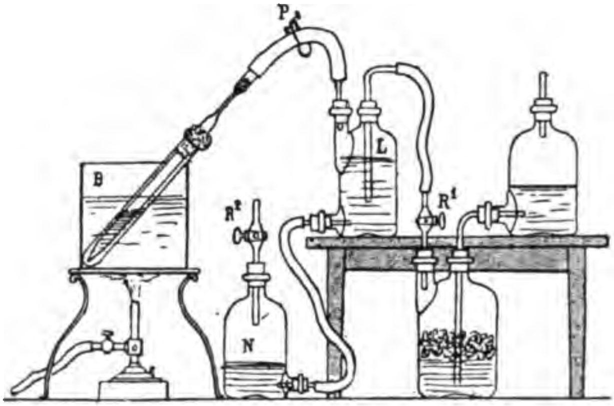

Fig. 48.

pipette, with a content of 9–10 c.cm., pointed at its lower and narrowed at its upper part, to which is attached the hydrogen apparatus, which serves to replace the air of the pipette and the culture tube by hydrogen, and also to aspirate the culture into the pipette. The medium being liquefied and inoculated with the water to be tested, the pipette is flamed and attached to the hydrogen apparatus, from which a rapid current of gas is passed ; after closing the cock P, the pipette is placed in the culture tube and wedged in with wool ; the cock P is then opened gently, and a continuous current of hydrogen is passed for a few minutes, when the cock R^1 connecting with the gasometer is closed, and the cock R^2 on

* Ann. Inst. Pasteur, xx. (1906) p. 155.

the levelling flask is opened; thereupon the culture is drawn up into the pipette, which, when filled is sealed in the flame and placed in the incubator at 37° C.

Vessel for receiving Blood.*—J. Bronstein describes the following apparatus (fig. 49). It consists of a cylinder provided with two small tubes (*a* and *b*) carrying short rubber tubing, and closed with wool plugs; the upper opening of the cylinder has a wool plug and a rubber cap. In this state the whole is sterilised in an autoclave. Into the jugular vein of a horse is introduced the hollow needle, provided with a rubber tube and a glass end-piece, and this is attached to the lowest tube (*a*) of the cylinder, the wool plug being removed, and the blood is allowed to flow in up to the mark 1 L; the rubber tube is then closed by a clamp, and the cylinder is disconnected; the separated serum is removed by the upper tube (*b*).

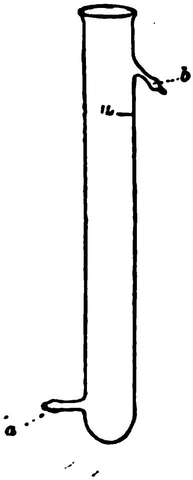

Fig. 49.

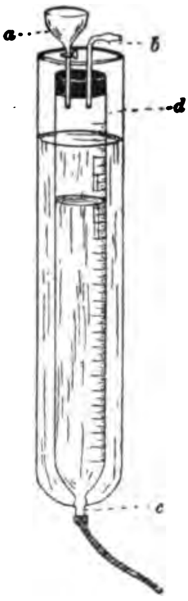

Fig. 50.

Apparatus for Intravenous Injection.†—J. Bronstein describes the annexed arrangement (fig. 50) for intravenous injection. The culture fluid or emulsion to be injected is passed through a filter (*a*) provided with a stop-cock; the tube (*b*), plugged with wool, conveys a current of air; the lower part of the vessel ends in a bulb, to the open end of which is attached a rubber tube carrying a hollow needle; the outer cylinder (*d*) contains warm water, whereby the culture fluid during the process of injection is kept at the body temperature.

* Centralbl. Bakt., Orig. 1te Abt., xl. (1906) p. 583. † Loc cit.

Detection of Bacillus Coli in Water.*—A. T. Venema uses the following method for detecting *B. coli* in water. To 50 c.cm. of acid bouillon (ordinary sterile broth that has not been made alkaline) is added 5 c.cm. of water; the mixture is then kept for 24 hours at 37° C. From this culture fluid, plates on Drigalski-Conradi-lackmus agar, and on Endo's fuchsin agar, are prepared; the colonies of *B. coli* which appear within 14–24 hours, are subjected to morphological and cultural tests. By this method the author has succeeded in detecting this organism in water, when other methods have failed to demonstrate its presence.

Rapid Filtration of Nutrient Agar.†—Babucke employs the following method:—30 grm. of meat extract and pepton (Witte) is added to 300 c.cm. of boiling water, and stirred at boiling point until dissolved; the solution is then made up to 3 litres by addition of water, and the whole heated to 100° C.; 90 grm. of finely divided agar is then added, and, when dissolved, the mixture is steam-sterilised for an hour. The filter, previously sterilised, consists of a zinc funnel 21 cm. diameter at the top and 3 cm. at the neck; the top is covered with a four-fold layer of fat-free wool, which, after soaking in water, is pressed down into the funnel, though still extending over the rim. The prepared nutrient agar is then poured out from the steamer in small quantities, on to the wool filter. The filtration takes at slowest 20–25 minutes. By this arrangement it is possible to obtain 3 litres of a 3 p.c. nutrient agar within at most 2 hours.

Cultivation of Bacillus Tuberculosis on Potato.‡—J. Anzilotti advocates the cultivation of *B. tuberculosis* on alkalin potato, using Roux's tubes, in the bulb of which is 6 p.c. alkalin solution of glycerin. The author finds that growth is more rapid and more vigorous than on other media; that the cultures retain their vitality longer without loss of virulence, and possess a higher virulence and toxicity; and are very suitable for research purposes and for establishing homogeneous cultures for the estimation of agglutination properties.

Cultivation of Azotobacteria.§—R. Perotti has detected the presence of an azotobacterium morphologically and culturally resembling the *Azotobacterium Chroococcum* of Beijerinck, in ten different soils obtained from various and widely separated districts of Italy. He pours into an Ehrlenmeyer flask of 250 c.cm. content, 25 c.cm. of Beijerinck's solution, and adds 0·2 grm. of the soil to be examined; the whole is shaken and allowed to stand at a temperature of 28° C. for 10 days, when it is examined macroscopically and microscopically; agar plates are made, and sub-cultures are prepared on nutrient media containing greater or less amounts of nitrogenous substances.

Method of detecting Bacillus Anthracis in the Blood and Tissues.‖ J. Forster spreads plaster-of-paris plates moistened with Loeffler's bouillon with a thin layer of the blood or material; he finds that spore

* Centralbl. Bakt., Orig. 1te Abt., xl. (1906) p. 600.
† Tom. cit., p. 607. ‡ Tom. cit., p. 765.
§ Atti R. Accad. Lincei, xv. (1906) p. 295.
‖ Centralbl. Bakt., Orig. 1te Abt., xl. (1906) p. 751.

formation occurs within a much shorter period than on ordinary culture media—viz. at 37° C. within 8–9 hours.

Isolating Intestinal Bacteria.*—H. de R. Morgan, in a research on the bacteriology of the summer diarrhœa of infants, took a small portion of fæces, or scrapings, from the mucous surface of the intestine, and made an emulsion thereof with pepton beef broth. From this the bile-salt neutral-red lactose-agar plates of MacConkey were inoculated, and incubated for 24 hours at 37°. Next day the colourless colonies (i.e. non-lactose fermenters) were picked off and put into tubes of lactose broth. After 3 days' incubation, those which had not produced acid and gas were used to inoculate gelatin tubes. The presence of the bile salt was found to exclude all except intestinal bacteria, and after a lapse of six weeks all the cultures which had not liquefied the gelatin were further examined with a view to determine their morphological and pathological characters.

Studying the Histology of the Pancreas.† — S. Tschassownikow, in a study of the histological changes in the pancreas after ligature of the duct, found that the best fixatives were 10 p.c. formalin and Podwyssotzki's fluid, though neither of these sufficiently differentiated the islands from the cells with zymogen granules. This requirement was fulfilled by first flushing the viscus through the cœliac artery with physiological salt solution, and then injecting with Hermann's fluid. This completed, the pancreas was cut up, and the pieces immersed in Hermann's fluid for about 24 hours.

Paraffin sections were stained by Reinke's modification of Flemming's orange method, but usually with safranin and methyl-green.

Apparatus for collecting Blood for Bacteriological Examination. At the April Meeting, R. G. Hebb exhibited an apparatus (fig. 51) for

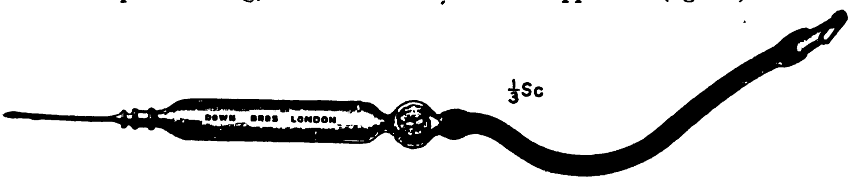

Fig. 51.

obtaining blood for cultivation purposes. It is very simple, and consists merely of a piece of glass tubing and a canula needle. The tube, which holds about 10 c.cm., has its front conical end accurately ground so as to fit the canula. The other end is constricted in two places, so as to form a small bulb, which is stuffed with cotton wool. To this end is attached a piece of rubber tubing with a glass mouth-piece for the purpose of exerting suction if necessary. The syringe has been found to work well, and is easily cleaned and sterilised. It is made by Down Brothers.

* Brit. Med. Journ., 1906, i. pp. 908–12.
† Archiv Mikrosk. Anat., lxvii. (1906) pp. 758–72 (1 pl.)

Studying the Cell-Forms of Connective Tissue.* — A. Maximow obtained good results from supra-vital staining with neutral red. A saturated solution of neutral red in physiological salt solution was injected into the intramuscular tissue of an animal just killed, and after 1–2 minutes the piece of swollen tissue was snipped off and examined under the Microscope. Bone marrow, spleen, and blood were examined by Jolly's method.

For permanent preparations the tissue was fixed in Zenker's fluid, in formol-Zenker, or in alcohol, and then imbedded in celloidin or paraffin, mostly the former. The sections were stained with polychrome methylen-blue, iron-hæmatoxylin and van Gieson, or with hæmatoxylin-acid-fuchsin and aurantia.

For "mast" cells, celloidin sections of alcohol fixed material were stained with a saturated solution of thionin in 50 p.c. alcohol for 24–48 hours, followed by alcohol; xylol; balsam.

The author makes a clear distinction between mast cells and plasma cells; the former are distinguished by the granules in the cytoplasm; the latter are round or polygonal, and their protoplasm stains deeply with basic anilin dyes.

Collecting Material for Study of Sargassum filipendula.†—E. B. Simons collected the material near the shore of Woods Hole late in July and during August. Plants, both in vegetative and reproductive conditions, were abundant. Flemming's weak solution (1 p.c. chromic acid 25 c.cm., 1 p.c. acetic acid 10 c.cm., water 65 c.cm.) proved a satisfactory killing and fixing reagent. Sections 5 μ thick were stained either with iron-alum-hæmatoxylin, or with safranin and gentian-violet.

Studying the Morphology and Development of Empusa.‡—E. W. Olive found in horse-dung cultures a fly belonging to the genus *Sciara*, which was infected with an *Empusa*. This fly has, since March 1904, been propagated along with its attendant disease, and many generations have furnished material for the cytological and developmental study of *Empusa*. The material was killed and fixed with a variety of agents, mostly with varying strengths of Flemming's chromic-acetic-osmic acid mixture. The insect body was generally cut in two, or pricked, to allow direct contact of the fixative and the fungus hyphæ in the body cavity. The sections, 3–6 μ thick, were stained with Flemming's safranin-gentian-violet-orange G. solution, or with Heidenhain's iron-hæmatoxylin.

"Blowing" of Condensed Milk Tins.§—G. H. Pethybridge finds that the "blowing" of condensed milk tins is due to small yeasts, or torulæ, which are present in large numbers. Unlike other organisms found in milk, these small yeasts are not inhibited by increasing the concentration of the cane sugar; in fact, they are capable of fermenting saturated solutions of cane sugar in milk.

Cultivations from the clots were made in Pasteur's solution at 20°, and from these, plates and sub-cultures. The organism grew freely on

* Archiv Mikrosk. Anat., lxvii. (1906) pp. 680-757 (3 pls.).
† Bot. Gazette, xli. (1906) p. 163 (2 pls.). ‡ Tom. cit., p. 195 (2 pls.)
§ Economic Proc. Roy. Dublin Soc., i. (1906) pp. 306–20.

any medium which contained glucose or cane sugar, and abundance of gas was produced in cane sugar gelatin shake cultures.

Experiments with sound tins of milk were made for the purpose of proving that the blowing was due to the vital activity of the small torula. The results were positive.

Investigation of the cane sugar used in the manufacture of a batch of blown tins, proved the absence of the torula, though a gas-forming bacterium was isolated from some cultures. But though this organism had the power of forming gas, it was shown that this activity was inhibited by increase of sugar in the medium.

(2) Preparing Objects.

Demonstrating Life-Cycle of Cystobia irregularis.*—H. M. Woodcock, when examining *Holothuria* and *Cucumaria* for "*Cystobia*" *irregularis* (Minch), stupefied the hosts by placing them in sea-water, to which a few crystals of menthol had been added. In *Holothuria* the parasites are seen as white oval spots in the lumen of vessels, or as spherical cysts attached to the wall. In *Cucumaria* the parasites are found in the respiratory trees, or attached by a stalk to the cælomic epithelium. The latter are adults, and enveloped by a double layer of epithelium.

The adults were usually fixed on the slide with osmic acid vapour (5 min.). After washing with water, the preparations were stained with dilute picrocarmin (Ranvier), and afterwards mounted in balsam.

Another method was to fix in saturated aqueous sublimate, to which 5 p.c. glacial acetic acid had been added. Such preparations were stained with carm-alum, or with alcoholic paracarmin.

For gregarines and for cysts, the sublimate acetic solution (20–40 minutes), or Flemming's fluid (2–4 hours), gave the best results. By the former method the material was stained in bulk with borax or paracarmin, by the latter on the slide. Sections of cysts were stained with iron-hæmatoxylin, followed by orange or eosin, with thionin and orange, with Kleinenberg's hæmatoxylin, and with other solutions, but those mentioned gave the best results.

Fixation Method for demonstrating Bacterial Capsules.†—H. Kayser exposes the films to the action of the vapour arising from 5 c.cm. 1 p.c. osmic acid, to which have been added 10 drops of acetic acid for about 2 or 3 minutes. After drying in the air, the film is washed for 1 minute with a dilute aqueous solution of permanganate of potash (a small crystal to 50 c.cm. water), and then washed in water.

Staining of the capsule may be done by the method of Klett, Johne, Heims, or others.

Demonstrating the Structure of Cladosphora Membrane.‡—F. Brand treated the material for at least 24 hours with acidulated dis-

* Quart. Journ. Micr. Sci., l. (1906) pp. 1-100 (6 pls.).
† Centralbl. Bakt., 1te Abt., Orig., xli. (1906) pp. 138–40.
‡ Ber. Deutsch. Bot. Ges., xxiv. (1906) pp. 64–70 (1 pl.).

tilled water, which had a softening and decalcifying effect. This was followed by Schultze's maceration fluid, and afterwards for a few minutes with very strong chromic acid solution. As the objects are brittle, and are rendered still more fragile by the reagents, much care must be taken during the manipulation. After washing out the chromic acid the preparation should be stained with a weak solution of Ruthenium red. No definite rule could be given for the action of the various reagents, as the different resistances of the various samples could not be previously estimated.

Studying the "Islets of Langerhans" in the Pancreas.*—H. H. Dale fixed the pancreas of dog, cat, rabbit, and toad in a mixture of sublimate and formalin. This was made fresh as required by mixing three or four volumes of a saturated aqueous solution of sublimate with one volume of formalin. In some cases sublimate alone was used. The pancreas of dog or cat was cut into thin slices; the rabbit's pancreas, being spread out into a thin layer in the mesentery, needed no such section; the toad's pancreas was fixed entire. After an immersion of 24 hours the tissue was washed for 24 hours in running water, passed through upgraded alcohols to xylol, and imbedded in paraffin in the usual way. Sections of toads' pancreas were made 5 μ thick, while those of the mammals varied from 2–4 μ.

The sections were stained with eosin and toluidin-blue (1 p.c. aqueous solution). The sections, freed from paraffin, were passed from alcohol to dilute tincture of iodine, to remove the sublimate. The iodine was washed out in 60 p.c. alcohol, and after passing through water the sections were stained with eosin. Excess of eosin was removed with 60 p.c. alcohol, until the zymogen granules could be seen under a low power stained more deeply than the rest of the tissue. The eosin was then fixed with dilute acetic acid, and after washing with distilled water the sections were stained with toluidin-blue. After the ordinary treatment the sections were mounted in balsam.

Fixing and Staining Cells of Embryo-Sac.†—J. Perriraz tried 17 different fixatives for his study of the directing spheres in the cells of the embryonic sac. The directing sphere is a term which includes the centrosome, the attraction sphere, and the aster. The author mixes solutions of silver nitrate, and mostly used the following: 1 p.c. osmic acid 4 c.cm., 1 p.c. nitrate of silver 35 c.cm., saturated aqueous solution of picric acid 25 c.cm., absolute alcohol 25 c.cm. The nitrate of silver is first mixed with the water, and then hot picric acid is added, and after this the osmic in absolute alcohol. The mixture is then heated for a few minutes in a water bath at 45°–50°, after which it is allowed to cool in a dark chamber.

The material is fixed in the dark at from 25°–30°, and then passed through graded alcohols. Then follows a graduated series of alcohol

* Phil. Trans., Series B., No. 197 (1905) pp. 25–46 (2 pls.). See also this Journal, 1904, p. 296.

† Bull. Soc. Vaudoise Sci. Nat., xli. (1905) pp. 213–56.

and xylol and of xylol and paraffin. In the first series are 4 gradations up to pure xylol; in the second series 6 gradations up to pure paraffin.

The ovaries are placed in the first series for 8 hours a stage. In the second series the melting point of the paraffin ranges from 35°–150°.

Staining was performed in three ways: (1) by staining in paraffin; for this methyl-green, methyl-blue or orange G., were mixed with liquefied paraffin; (2) staining *en masse* with some preparation of hæmatoxylin or of safranin; (3) staining of sections; for this safranin, gentian-violet and orange G., or Delafield's hæmatoxylin with safranin, were chiefly used.

Demonstrating Phagocytosis and Excretion in Branchiopods.*—L. Bruntz used in his researches *Chirocephalus diaphanus*. He injected filtered solutions of carminate of ammonia, anilin dyes and Indian ink, by means of a glass tube, one end of which was drawn out to a fine point. The tube was filled by capillarity, and then the point plunged into the pericardial sinus, care being taken not to damage the dorsal tube or the nerve chain. The fluid is then blown in, and as the circulation is very active the animals stain uniformly. The different dyes are eliminated at intervals varying from 10 minutes (indigo-carmin) to several hours (carminate of ammonia).

Demonstrating Reproduction in Gregarines.†—L. Brasil, for his researches on the reproduction of Gregarines, fixed the vesiculæ seminalis of *Lumbricus herculeus* in the following fluid: picric acid 1 grm., glacial acetic acid 15 c.cm., formalin 60 c.cm., alcohol (80 p.c.) 150 c.cm. The vesiculæ, cut up into small pieces, were immersed in the fixative for 24 hours, and on removal were washed, dehydrated in alcohol, and imbedded in paraffin. The sections were stained with iron-alum-hæmatoxylin; 24 hours in a 5 p.c. solution of iron-alum, and then for 36–48 hours in 0·5 p.c. solution of hæmatoxylin. The sections were after stained with an alcoholic solution of eosin and orange G., or of light-green and picric acid.

(3) Cutting, including Imbedding and Microtomes.

Studying the Development of the Ascocarp of Humaria granulata.‡—V. H. Blackman and Helen C. Fraser, in their research on the sexuality and development of the Ascocarp of *Humaria granulata* Quél. (= *Peziza granulata* Bull.), fixed the material chiefly in Flemming's weak fluid, which was allowed to act for 24 hours, or for 1 hour, fixation being completed in the latter case with Merkel's fluid. Either safranin, gentian-violet and orange, or Benda's iron-hæmatoxylin, were used for staining. Sections of the very youngest stages of the apothecia were secured by removing and fixing the superficial layers of the substratum on which apothecia were just visible. The behaviour of the closely packed nuclei of the ascogonium was best followed in sections 4 μ thick.

* Arch. Zool. Expér. et Gén., xxxiv. (1906) pp. 183–98 (1 pl.).
† Tom. cit., pp. 69–99 (2 pls.).
‡ Proc. Roy. Soc., lxxvii. (1906) pp. 354–68 (3 pls.).

Demonstrating the Structure of Mollusca.*—R. Anthony, in his study on the morphology of the acephalous Mollusca, made casts of the shells and of the palleal cavity by means of plaster, wax, or gelatin. For obtaining a cast of the cavity, two holes were made in the shell, and the plaster poured in through one hole by the aid of a funnel.

The mould set in a few hours, and then the shell and soft parts were removed, sometimes with the aid of acid.

Fixation was effected in a mixture of formalin 4 and alcohol (70 p.c.) 100. The material was imbedded in paraffin or collodion. Staining was sometimes effected *en masse*, at other times in sections. The usual tinctorial solutions were employed. Teasing out the muscle and dissociation were found to give better and more instructive results than sections. 20 p.c. nitric acid, allowed to act for 12–24 hours, was used.

For luting down the preparations, caoutchouc dissolved in benzin or sulphide of carbon was used. The caoutchouc dissolved in benzin was found to be specially useful for fixing up preparations mounted in aqueous media.

Marking the Directing Plane on Blocks for Reconstruction.†—K. Péter finds that Nubian waterproof blacking makes an excellent overlay for marking out the directing plane of blocks used for reconstruction models. The embryo is first imbedded in paraffin, and then the blacking is painted on with a brush. In a few minutes the surface dries, and then the block is covered with another layer of paraffin. It is equally suitable for paraffin and celloidin imbedding, and is applicable to all the usual procedures.

(4) Staining and Injecting.

Demonstrating the Presence of Spirochæta pallida.‡—E. Bertarelli and G. Volpino adopt the following method for staining *Spirochæta pallida* in tissues. Very small pieces, 0·6 to 0·7 mm. thick, are fixed in alcohol. They are then immersed in the silver solution for 3–4 days (silver nitrate 1·5, distilled water 50, alcohol (96 p.c.) 50, glacial acetic acid 4–5 drops). This fluid must be renewed as soon as a precipitate forms. The pieces are then frequently washed in distilled water, after which they are placed for 24 hours at room temperature in Van Ermengeum's reducing medium (tannin 3, gallic acid 5, sodium acetate 10, distilled water 350). This fluid must be changed as soon as it becomes cloudy. After a thorough wash in water the material is passed through alcohol chloroform to paraffin. The sections should be from 0·3 to 0·7 μ thick.

Simplified Method of Staining Blood Films.§ — R. Lenzmann stains air-dried blood films by the following method. Solution 1 consists of eosin 1·2, absolute alcohol 100, formol 5, sublimate 0·3; filter. To 10 c.cm. of this solution is added 1 c.cm. of the following methylen-blue solution: methylen-blue 0·8, absolute alcohol 100, 3 p.c. acetic

* Ann. Sci. Nat. Zool,, sér. 9, i. (1905) pp. 165-396 (57 figs. and 3 pls.).
† Zeitschr. wiss. Mikrosk., xxii. (1905) pp. 530–8 (2 pls.).
‡ Centralbl. Bakt., 1te Abt. Orig., xli. (1905) pp. 74–8 (1 pl.).
§ Zeitschr. wiss. Mikrosk., xxii. (1905) pp. 431–3.

acid 20 drops; filter. After the two solutions have been mixed, the staining solution is filtered again. Solution 2 consists of methylen-blue 2·4, borax 2·5, absolute alcohol 100; filter.

The procedure is simple. Drop on the film solution, and after about a minute add five times the quantity of distilled water; allow to act for about 1½ minutes, then wash in tap water. Next stain with No. 2 solution for some 20–30 seconds, wash again, dry on blotting paper, and mount in balsam.

For filtration thick papers are required, especially for No. 2 solution; for this 589 Schleicher and Schüll is recommended.

Azocarmin and Chromotrops as Contrast Stains.*—M. Heidenhain has obtained good results from the use of Azocarmin B. This pigment is an amido-acid, is easily soluble in alcohol, and imparts a beautiful ruby-red hue. It acts more powerfully when the material has been treated with some chromic acid salt.

The advantages of the chromotrops appear to be more numerous, and the author believes that they have a great future, and will supersede eosin. He has experimented with four kinds of these azo-derivatives of chromotropic acid, viz. 2 R, 2 B, 6 B, 7 B. The first two impart a yellowish-red hue, the latter pair a bluish tone. The procedure for staining is as follows: Hæmatoxylin-stained sections are transferred to 96 p.c. alcohol, and then treated with ammoniacal-alcohol (1 c.cm. ammonia to 1 litre of absolute alcohol). This turns the sections blue, and when this stage is arrived at they are placed in absolute alcohol again. From the latter they are transferred to an alcoholic chromotrop solution, which may be strong or weak.

After washing with absolute alcohol, the sections are passed through xylol and mounted in balsam.

Demonstrating Cytoryctes luis.†—G. Siegel, after alluding to the observations of Klebs in 1879, and of Döhle in 1892, states that he has found in the body-juices and cells of syphilis a motile parasite which he believes is a flagellate protozoon.

The parasites are demonstrable in films of blood or tissue-juice, by first staining with Grenacher's hæmatoxylin, and after differentiating with acid alcohol, contrast-staining with azur ii. (1 : 1000). The flagella are stained for 3 days in Giemsa's solution, which should be frequently changed, and warmed each time.

In sections, which should be very thin (2μ), the parasites are found within connective-tissue cells.

Inoculation experiments on monkeys and rabbits were successful.

Staining Spirochæta pallida.‡ — Davidsohn recommends Kresyl-violet R. extra for staining *Spirochæta*. As much as will go on the end of a knife-blade (? size) is dissolved in 100 c.cm. water.

* Zeitschr. wiss. Mikrosk., xxii. (1905) pp. 337–43.

† Münch. med. Wochenschr., 1905, Nos. 28, 29. See also Centralbl. Bakt., 1te Abt. Ref., xxxvii. (1905) pp. 480–2.

‡ Berlin Klin. Wochenschr, 1905, p. 985. See also Centralbl. Bakt., 1te Abt. Ref., xxxviii. (1905) p. 50.

Slide-Basket for Staining Twelve Sections Simultaneously.* — Kjer-Petersen mentions a basket (fig. 52) which he has had constructed for the purpose of facilitating the staining, etc., of films of tuberculous sputum. Though the method of using the apparatus is obvious, no directions are given, and no details as to its construction.

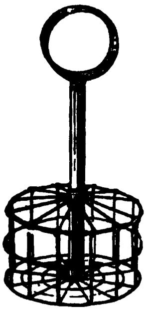

FIG. 52.

Staining Bacillus typhosus in tissues.†—P. Foa fixes the pieces in the following fluid:—sublimate 2 grm., Müller's fluid 100 grm., followed by alcohol, and then stains with a mixture of methyl-green and pyronin (Pappenheim's formula). In about 5 minutes the bacilli are stained deep red.

Modification of Flemming's Triple Stain.‡—V. Bonney has devised the following easy process of triple staining for cytological and histological purposes. It is based on the method of Flemming, a method which has received praise and blame. The pieces, which should be small, are fixed in acetic alcohol (glacial acetic acid 1 part, absolute alcohol 2 parts, or in Hermann's or Flemming's fluid. Imbed, and section in the usual way. Stain for 1 hour in saturated aqueous solution of safranin. Wash in water. Stain for a quarter of an hour in an aqueous saturated solution of methyl-violet. Wash in water, and wipe the slide dry, except the part occupied by the section. Flood the slide with the following solution: To 20 c.cm. of acetone add drop by drop a saturated aqueous solution of orange G. until the precipitate which appears on shaking is just dissolved in excess of the aqueous solution, then filter. Run off the fluid and flood again with the same solution, and when the section has assumed a faint brownish-pink colour, pour off the orange-acetone solution. Wash in acetone for a few seconds. Wash in xylol. Examine under a low power to see if the proper result has been attained. Then wash in two fresh changes of xylol. Mount in xylol-balsam.

Chromatic elements stain a rich violet; spindle fibres of mitosis a faint pink; cytoplasm a rose pink; intercellular tissue a pale yellow.

(5) Mounting, including Slides, Preservative Fluids, &c.

Demonstrating Pollen Grain Variation.§ — J. B. Pollock placed anthers, which were almost dehiscing, in Kleinenberg's hæmatoxylin for 24 hours. They were then washed in alcohol, and changed very gradually from 96 p.c. alcohol to clove oil. In this medium the pollen sacs were broken up, and the pollen grains thus set free were examined by mounting a drop of the oil containing them.

Method for making Permanent Preparations of Amyloid Degeneration.‖—P. Meyer finds that permanent preparations of tissues affected

* Centralbl. Bakt., 2te Abt., xvi. (1906) pp. 191–2 (1 fig.).
† Giorn. R. Accad. Med. Torino, 1905, Nos. 5–6. See also Centralbl. Bakt., 1te Abt. Ref., xxxviii. (1906) p. 50.
‡ Lancet, 1906, i. p. 221.
§ American Naturalist, xl. (1906) pp. 253–86 (16 figs.).
‖ Virchow's Archiv, clxxx. (1905) pp. 359–61.

with the lardaceous change can be obtained by merely drying. The preparations are stained with methyl-violet, differentiated with very dilute acetic acid, washed in water and dried in the air. They are then cleared up in xylol, and mounted in balsam. This method, which, of course, is only applicable to paraffin sections, does not succeed with iodine.

(6) Miscellaneous.

New Method of enumerating Leucocytes.*—W. B. Leishman, at a meeting of the Pathological Society of London, held March 20, 1906, described a method of enumerating leucocytes, by which it was possible to dispense with the use of expensive apparatus, of a special diluting fluid, and of a mechanical stage. Two pipettes are required, one an ordinary 1 c.cm. pipette graduated to 0·01 of a c.cm., and the other a capillary pipette to deliver 5 c.cm. Five (5) c.cm. of the blood to be treated is taken into the capillary pipette and at once diluted 200 times by being blown into 995 c.cm. of water, previously measured by the larger pipette. The mixture is well stirred and shaken, and two successive volumes of 5 c.cm. are taken and discharged side by side on a slide. The drops are allowed to dry, and then stained with Leishman's stain. The whole number of the leucocytes are then counted by the aid of a ruled cover-glass in the following way:—A drop of Leishman's stain is allowed to evaporate on the surface of a cover-glass; a thin film is left, insoluble in water or cedar-oil, in which is ruled a series of parallel lines, with the point of a needle. A drop of cedar-oil is then placed on the film, and on it is dropped the cover-glass, ruled surface downwards. Both drops are then counted. In this way the whole of the leucocytes in 10 c.cm. of the diluted blood are enumerated, and the number in 1 c.cm. of blood is obtained by multiplying the result by 20. In dealing with leukhæmic, or with leucopenic blood, the dilution is readily altered to facilitate counting. As compared with Gower's hæmocytometer, the readings by the author's method underestimates by about 5 p.c.

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Philadelphia: 2nd revised and enlarged edition, 1904, 8vo. 528 pp., and plates.

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Moller, J.—**Mikroskopie der Nahrungs-und Genussmittel aus dem Pflanzenreich.**
Berlin: Jul. Springer (1905) xvi. and 599 pp., 599 figs.; 2nd edition, revised and enlarged with the collaboration of A. L. Winton.

Senft, E.—**Mikroskopische Untersuchung des Wassers mit bezug auf die in Abwässern und Schmutzwässern vorkommenden Mikro-organismen und Verunreinigungen.** Wien: Jos. Šafár (1905) 196 pp., 180 figs. in text and 10 plates.

* Brit. Med. Journ., (1905) i. p. 680.

Metallography, etc.

Measurement of Stress by Thermal Methods.*—It has long been known that a thermal effect is produced when bodies are subjected to stress, and formulæ expressing the relation between change of temperature and stress have been worked out. E. G. Coker has experimentally investigated this relationship for tension and compression stresses on metals. As the coefficient of expansion enters into the equation, it was considered necessary to determine if variation of stress had any effect upon the coefficient. Steel and brass tubes were subjected to definite tension stress, and their expansion on heating measured by means of a Ewing extensometer, alteration of temperature being effected by circulation of water through the tube. It was found that there was no difference in the linear expansion of brass and steel within the range of stress up to the yield point. In the determination of the relation between thermal change, stress, and strain, bars were loaded in a testing machine, elongation being measured by an extensometer, and temperature variations by a thermopile connected with a galvanometer. The cooling effect caused by tensile stress could thus be measured with extreme delicacy. Similar determinations were made of the heating effect, stress, and strain in test pieces subjected to compression. The author concludes that the thermal change is very nearly proportional to the stress, in the same way as the strain. The directions in which the methods employed are capable of practical application are indicated.

Overstraining of Iron by Tension and Compression.†—When iron is overstrained in tension, its elastic limit in tension is raised, if recovery from the temporary effects of overstrain be allowed to take place. The elastic limit in compression, however, is lowered, according to some authorities, while others appear to take the view that it also is raised. J. Muir gives an account of some tests bearing on this question. A test piece was stressed in compression beyond its yield point. It was then placed in boiling water for ten minutes. A second compression test gave a yield point higher than the maximum stress applied in the first loading. Test pieces were then cut from bars which had been overstrained in tension; they were warmed to effect recovery from overstrain, and subjected to compression stress. It appeared that the compression yield point had been raised by the overstrain in tension, but not to the same extent as the tension yield point. The author suggests that overstraining hardens the material, both as regards resistance to tension and compression, but that the process of recovery from tensile overstrain raises the tension yield point above the overstraining stress, and lowers the compression yield point below the overstraining stress, by approximately an equal amount. The author points out that his experiments were not satisfactory in some respects, and that further research is desirable.

* Trans. Roy. Soc. Edinburgh, xli. (1905) pp. 229–50 (11 figs.).
† Proc. Roy. Soc., Series A, lxxvii. (1906) pp. 277–89 (5 figs.).

Manufacture of Cartridge Cases for Quick-firing Guns.*—L. Cubillo and A. P. Head describe the properties of the brass (Cu 67 p.c. Zn 33 p.c.) used for this purpose. An examination of the cooling curve of this alloy leads to the conclusion that it is a eutectic. The cold-drawing operations to which the metal is subjected necessitate frequent annealing; the most suitable temperature is 620°–650° C. The value of microscopic examination of metals is pointed out, and five photo-micrographs of brass, both in the annealed and cold worked states, are given. The processes of manufacture of cases are described in detail.

Iron-Carbon Alloys with high percentages of Carbon.†—Recognising the unsatisfactory character of the theory of iron-carbon alloys, elaborated by Roozeboom, as applied to high carbon alloys, F. Wüst determined the cooling curves of a series containing 2·56–4·82 p.c. carbon. The percentage of elements present other than iron and carbon was very small. The curves relating to eight of the alloys are given. According to the theory, graphite should be the first constituent to separate during solidification of the 4·82 p.c. alloy, and should rise to the surface owing to its relatively low specific gravity. This was not found to be the case. The lower freezing point varied from 1112°–1149° C. No thermal change was detected between this point and the evolution of heat caused by the formation of pearlite at about 700° C. The author's work supports the conjectures of Osmond and Heyn, that the formation of cementite takes place at 1135° C. The structure of many of the alloys, illustrated by photomicrographs, is described in detail. The non-reversible change (cementite = ferrite + temper carbon) occurring when alloys containing free cementite are heated at a high temperature, is held to uphold Heyn's assumption that the system ferrite + carbon is stable, the other systems being phenomena due to rapid cooling.

A Defective Bar of Tool Steel.‡—C. E. Corson gives a number of interesting photomicrographs of a bar of crucible steel containing 1·72 p.c. carbon. A finishing tool made from the steel failed after being in use a very short time. The fracture at one place in the bar was fine grained, while at another point it was coarse. The author concludes that the steel had been slowly cooled from a temperature varying considerably in different parts of the bar.

Liquid Crystals and Plastic Crystals.§—Certain organic bodies on melting yield a liquid which is not clear, and has the property of double refraction, indicating a decided orientation, though no indication of crystalline structure is afforded by external form. At a somewhat higher temperature the liquid becomes clear, and loses its abnormal optical properties. Other substances, of great viscosity, exist as soft crystals, frequently having rounded extremities. These plastic crystals are deformed by the application of very slight forces. An account of these singular phenomena is given by Etienne, who points out that

* Engineering, lxxx. (1905) pp. 548–75 (47 figs.).
† Iron and Steel Mag., xi. (1906) pp. 185–211 (27 figs.).
‡ Tom. cit., pp. 281–6 (10 figs.).
§ Rév. Metallurgie, iii. (1906) pp. 129–36 (6 figs.).

metals of undoubted crystalline structure are plastic within certain ranges of temperature. If a plastic crystal be cut in two, each portion assumes the form of the original crystal. Two plastic crystals in contact frequently combine to form one crystal. It is possible to deform a plastic crystal without changing its orientation. The theories of Lehmann, Tammann, and others, as to the nature of doubly-refracting liquids, are briefly stated.

H. le Chatelier * points out that the growth of metallic crystals at certain temperatures, and also the capacity exhibited by some metallic crystals of being deformed without change in crystalline orientation, are exactly the same phenomena as those observed in the plastic crystals referred to above. As the method of examination by polarised light cannot be employed for the study of metals, since they are not transparent, it is hoped that the researches now being conducted upon soft crystals of organic bodies may throw light on the constitution of malleable metals.

Recent Researches upon Industrial Alloys.†—L. Guillet reviews the work carried out on alloys during the last few years. A classification of binary alloys is given, based upon the capacity of the two metals to form either definite compounds, or solutions of one metal in the other, both in the liquid and solid states. The importance of solid solutions is insisted upon. A concise account of methods used in the investigation of alloys is given. The most important of these methods is microscopical examination of prepared sections, which has the advantages of being rapid and inexpensive. Information of great value may be obtained by a study of a complete freezing point curve. The author proceeds to deal with a large number of alloys in some detail; among those considered are the iron-carbon series and the special steels, the alloys of copper with tin, phosphorus, aluminium, nickel, silicon, vanadium, chromium, tungsten, etc., the antifriction alloys, and the aluminium-manganese alloys, some of which are magnetic. The refinement of methods of determining thermal changes upon heating or cooling, has led to the discovery of transformation points in the bronzes and other alloys.

Quenching of Steel.‡ — A. le Chatelier discusses a theory of the hardening of steel by quenching, published by him in 1895, and recently revived by Grenet, in which the effects were ascribed to deformation (*écrouissage*) of the metal. The change in volume accompanying the transformation of steel on cooling, causes internal stresses of great magnitude when the metal is quenched from a temperature above the change point. The author considers that the deformation caused by these stresses hardens the steel, while Grenet's view is that the hardness is due to a change of texture. Arguments tending to show that the two views are in essential agreement, are advanced.

Cementation.§—Ledebur combats the theory of cementation of steel advanced by Guillet, and takes the view that the solid carbon is directly

* Rév. Metallurgie, iii. (1906) pp. 105–6.
† Tom. cit., pp. 155–79 (28 figs.). ‡ Tom. cit., pp. 211–16.
§ Tom. cit., pp. 222–6.

absorbed by the iron. Experiments in which iron was carburised by heating in contact with sugar charcoal, and wood charcoal, showed that the formation of gaseous compounds was not necessary for cementation to take place.

L. Guillet * replies to Ledebur's criticisms. He has shown that the active agent in cementation is always a cyanide or a carbide, and that carbon alone is not absorbed when heated in contact with iron. Ledebur's proofs to the contrary are inconclusive.

ANDREWS, T.—**Microscopic Observations on Naval Accidents.**
Engineering, lxxix. (1905) pp. 563–6 (16 figs.), and lxxx. (1905) pp. 235–9 (24 figs.).

BERTHELOT & G. ANDRÉ—**Recherches sur quelques métaux et minerais trouvés dans les fouilles du Tell de l'Acropole de Suse en Perse.**
Comptes Rendus, cxlii. (1906) pp. 473–80.

DE FRÉMINVILLE, C.—**Influence des vibrations dans les phénomènes de fragilité.**
Rev. Metallurgie, iii. (1906) pp. 109–21 (3 figs.).

SANKEY, H. R.—**Impact Testing.** *Eng. Mag.*, xxx. (1906) pp. 913–14.

WATERHOUSE, G. B.—**Nickel Steel, and its Application to Boiler Construction.**
[Nickel steel, especially that containing about 30 p.c. nickel, has properties which render it highly suitable for boiler construction.]
Iron and Steel Mag., xi. (1906) pp. 301–7.

* Rév. Metallurgie, iii. (1906) pp. 227–8.

PROCEEDINGS OF THE SOCIETY.

MEETING

HELD ON THE 18TH OF APRIL, 1906, AT 20 HANOVER SQUARE, W., G. C. KAROP, ESQ., M.R.C.S., ETC., VICE-PRESIDENT, IN THE CHAIR.

The Minutes of the Meeting of the 21st of March, 1906, were read and confirmed, and were signed by the Chairman.

The List of Donations to the Society (exclusive of exchanges and reprints) received since the last Meeting, was read, and the thanks of the Society were voted to the donors.

	From
Kircher, Athanasius, De Arte Magnetica. 2nd ed. (4to, Coloniæ Agrippinæ, 1643) . . . . . . Porta, John Baptista, Natural Magic. (4to, London, 1669)	*Messrs. Baxter, Disney, Michael, and Radley.*
The Wild Fauna and Flora of the Royal Botanic Gardens, Kew	*The Director, Royal Gardens, Kew.*

Dr. Hebb showed some cultures of bacteria on blood serum and agar which were preserved in formalin. The cultures were killed and at the same time mounted by pouring into the test tube 10 p.c. formalin, on the top of which was placed a mixture of melted paraffin-wax and vaselin. When cool, the plug adapted itself to the surface of the formalin, forming an air-tight and stable cylindrical stopper. The upper end of the tube was stuffed with cotton wool, and covered with a caoutchouc cap.

The specimens shown were *B. typhosus*, the butter bacillus, *B. subtilis*, *Micrococcus pyogenes aureus* and *albus*, and a mixed culture of cocci from the throat. The cultures exhibited had been prepared some two months ago, and still retained their characteristic appearance, which was well seen through the transparent media. The exhibitor remarked that the method was not adapted for cultures of every description of organism, as some, e.g. glanders, were dissolved off the surface by the preservative fluid.

Dr. Hebb also exhibited some tubes filled with sterilised nutrient broth and plugged in the same way as the formolised cultures previously described. The object of the plug was to allow the tubes to be transported from place to place without damage or loss of the medium. In order to remove the plug, it was merely necessary to warm the tube, though in the case of the smaller tubes this may be done by pushing a hot needle through it and allowing it to cool. The plug was then easily pulled out. Both these devices, which had been found in practice to be extremely useful, were due to the ingenuity of Mr. F. Chopping, the Laboratory Assistant at Westminster Hospital.

Dr. Hebb also exhibited a syringe for obtaining blood for bacte-

riological examination. This apparatus is described in another part of the Journal.

The Chairman said it was very interesting to know of the methods described by Dr. Hebb, and he thought the idea carried out by the syringe was one which would be appreciated by all who had to use such things, as the sterilising of the apparatus was a matter of the greatest importance. The preservative method was excellent as far as it was available, but of course it would not answer for every kind of bacteria.

A hearty vote of thanks to Dr. Hebb was unanimously carried.

A series of coloured lantern slides, from microscopic sections and preparations, illustrative of plant structure, was then shown upon the screen. These had been prepared by Mr. A. Flatters, F.R.M.S., of Manchester, and were lent by him for exhibition. A list of the subjects, with brief explanations of the special points it was intended to illustrate, was read by Dr. Hebb as the exhibition proceeded. The slides, which were 86 in number, comprised sections of stems cut in various directions, growing points of buds and their successive stages of development, germination and growth of seeds, *Uredo* in barley and wheat, ovaries, cell-division, etc. The excellence of the photographs, and the exceptionally fine way in which many of them were coloured, were particularly remarked.

The Chairman hoped the exhibition of this fine series of slides had been appreciated by the Fellows present. They were greatly indebted to Mr. Flatters for sending them up for the purpose, and to Dr. Hebb for reading the descriptions.

A hearty vote of thanks was unanimously passed to each of these gentlemen.

The following Instruments, Objects, etc., were exhibited:—

Dr. Hebb:—Apparatus for obtaining blood for bacteriological examination and cultivation; cultures of bacteria on blood serum and agar preserved in formalin; test-tubes containing sterilised nutrient broth plugged for transmission from place to place; 86 lantern slides illustrating plant structure, lent for exhibition by Mr. A. Flatters.

New Fellows.—The following were balloted for and duly elected *Ordinary* Fellows of the Society: Messrs. Walter Imboden and Thomas James Smith.

MEETING

HELD ON THE 16TH OF MAY, 1906, AT 20 HANOVER SQUARE, W., DR. D. H. SCOTT, F.R.S., ETC., PRESIDENT, IN THE CHAIR.

The Minutes of the Meeting of the 18th of April, 1906, were read and confirmed, and were signed by the President.

The List of Donations to the Society since the last Meeting (exclusive of exchanges and reprints) was read, and the thanks of the Society were voted to the donors.

	From
Loeb, J. The Dynamics of Living Matter. (8vo, New York, 1906)	*The Publishers.*
An Old Microscope	*Mr. H. J. Morgan.*

Mr. Rousselet said that the Old Microscope presented to the Society was an interesting specimen of a type of which they hitherto had no example. The maker's name was unknown, and its age was uncertain; but though it was in a very good state of preservation, it probably dated from the latter part of the eighteenth century. The focusing was effected by the movement of the stage, and the objectives were simple lenses; and although not of any great value as an optical instrument, it was a very welcome addition to the Society's collection.

Dr. J. M. Bernstein gave an interesting account of some observations recently made on the parasites of malaria, and the phagocytic action of the polymorphonuclear leucocytes, as observed by himself and the late Mr. R. W. Newman at the Clinical Laboratory of the Westminster Hospital; the subject being illustrated by a large number of drawings upon the board, showing the results of observations taken at intervals of a few minutes for 5 hours.

Dr. Hebb said he could vouch for the accuracy of the observations of Dr. Bernstein and Mr. Newman, for he had frequent opportunities of inspecting the progress of the phagocytosis. He first of all saw the malaria crescent with a leucocyte gradually crawling up to it, then another, and afterwards a third, all three of which attacked the same parasite; finally, one got the better of it and incorporated it, and probably killed it. The next morning he saw it as it was shown under the Microscope on the table that evening.

The thanks of the Society were voted to Dr. Bernstein for his very interesting communication.

Mr. Beck exhibited and described an apparatus designed by Mr. Nelson, in conjunction with Mr. J. W. Gordon, for the purpose of testing colour screens, which was roughly described as consisting of a diffraction grating, a simple slit, a collimating lens, and an eye-lens through which to view it, and mounted so as to be able to traverse the whole of the spectrum. It was extremely simple, as might be judged by the easy

way in which Mr. J. W. Gordon worked out a method of measuring wave-lengths from this instrument without any reference to tables—(Mr. Gordon's diagram was here shown and explained)—wave-lengths being read off in millionths of an inch. The apparatus formed a simple and quite inexpensive spectrometer.

Mr. Rheinberg said that a few months ago he had had the honour of exhibiting to them a series of photographs of diatoms taken by Dr. A. Köhler with the Zeiss ultra-violet light apparatus. By that gentleman's kind permission, he was enabled to show them that evening a further very fine set of about 35 ultra-violet light photomicrographs of physiological, botanical, and other subjects. Special attention was directed to a series of photos of cells of *Salamandra maculosa*, in various stages of cell-division; and attention was also drawn to a section through the eye of a tadpole, in which the crystalline lens appeared black—this being a good example of the changed appearance of structure which may arise from the fact that bodies transparent to ordinary light may be more or less opaque to ultra-violet rays.

The thanks of the Society were voted to Mr. Beck and to Mr. Rheinberg for their exhibits.

A letter from the Secretary of the Selborne Society was read, inviting the assistance of Fellows of the R.M.S. as exhibitors at the conversazione to be held on May 25.

The President said they were unable to devote any time to observations upon the matters which had been brought before the Society, as that was the great evening of the year with them, when they had their exhibition of microscopic pond-life. He wished to express the thanks of the Society to those who were exhibitors on that occasion, and to say that they were particularly grateful to the Members of the Quekett Club who had shown their good feeling and loyalty to the Society by coming forward in such large numbers to contribute to the success of the evening. The thanks of the Society were also due to Mr. Baker for the loan of a number of Microscopes for the exhibition of objects.

The votes of thanks being put to the Meeting were unanimously carried.

New Fellows.—The following were elected *Ordinary* Fellows: Messrs. Clement Campbell Ellis and Mansell James Swift.

The following Instruments, Objects, etc., were exhibited:—

Mr. Conrad Beck:—A Simple Wave-length Spectroscope.

Dr. J. M. Bernstein:—Phagocytosis of the Malarial Parasite; Blood-film showing leucocyte containing pigment, the remains of a malarial parasite, stained with methylen-blue and eosin, × 1000.

Mr. J. Rheinberg:—A series of 35 photomicrographs of physical, botanical, and other subjects, taken by Dr. Köhler with the Zeiss ultra-violet light apparatus.

Mr. J. M. Allen :—*Melicerta ringens.*

Mr. F. W. Watson Baker :—*Melicerta ringens.*

Messrs. R. and J. Beck :—*Hydra vulgaris* infested with *Trichodina pediculus* ; *Volvox globator.*

Mr. Jas. Burton :—" Water Boatman "; *Nitella*, showing antheridia and oogonia, also circulation of protoplasm.

Mr. T. A. Delcomyn :—*Fredericella sultana.*

Mr. A. Downs :—*Coleps hirtus* ; *Stentor niger* and *S. viridis* ; *Volvox globator.*

Mr. T. D. Ersser :—Water-louse, showing the circulation.

Mr. F. W. Eyre :—*Asellus*, showing circulation.

Mr. Alfred E. Hilton :—*Spongilla fluviatilis*, living, showing reproductive gemmules.

Mr. E. Hinton :— *Cristatella mucedo*, with statoblasts, mounted specimen.

Mr. J. T. Holder :—*Melicerta ringens.*

Mr. H. S. Martin :—Desmids, various.

Mr. F. A. Parsons :—*Stephanoceros Eichhorni.*

Mr. F. J. W. Plaskitt :—Living diatoms.

Mr. G. H. J. Rogers :—*Lophopus crystallinus* ; *Volvox globator.*

Mr. C. F. Rousselet :—*Cordylophora lacustris* ; *Plumatella repens* ; *Zoothamnium geniculatum* ; *Melicerta janus* ; Rotifers, various.

Mr. D. J. Scourfield :—Nauplius (larval) stage of *Cyclops.*

Mr. C. J. H. Sidwell :—Second stage of *Cyclops* ; *Cyclops serrulatus* (adult female with ovisacs).

Mr. J. H. Pledge :—Third stage of *Cyclops.*

Mr. C. D. Soar :—*Piona nodatus.*

Mr. A. G. Soutter :—*Vorticella* sp.

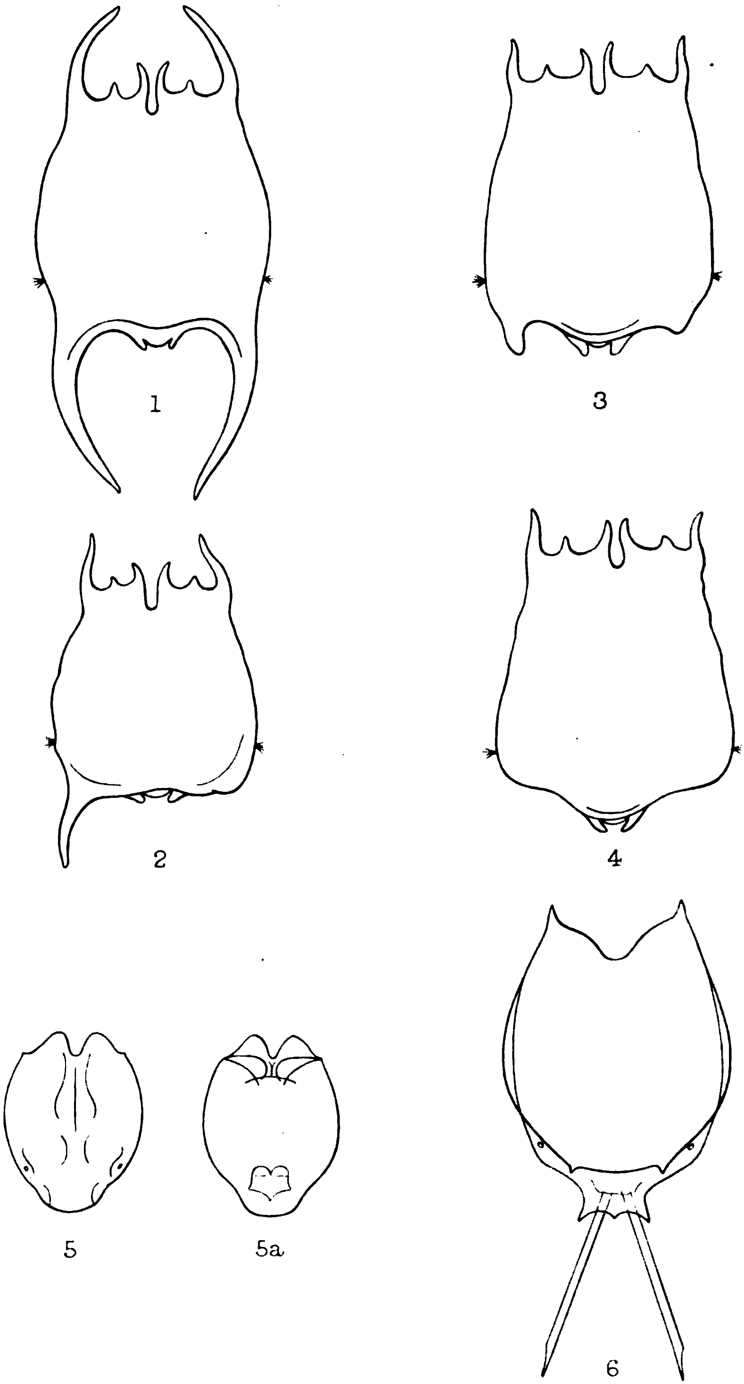
Mr. H. Taverner :—Water-Mites, various.

Mr. W. R. Traviss :—*Brachionus* sp.

Mr. C. Turner :—*Notops brachionus* ; *Rhinops vitrea* ; *Triarthra longiseta* ; *Polyarthra platyptera.*

ADDENDUM.

We are indebted for the loan of Plates VIII., IX., X., and XI., to the courtesy of the Quekett Microscopical Club.



F R Dixon-Nuttall del ad nat

West, Newman lith.

South African Rotifers.

JOURNAL

OF THE

ROYAL MICROSCOPICAL SOCIETY.

AUGUST, 1906.

TRANSACTIONS OF THE SOCIETY.

IX.—*Contribution to our Knowledge of the Rotifera of South Africa.*

By Charles F. Rousselet, Curator and F.R.M.S.

(*Read March* 21, 1906.)

Plates XIV. and XV.

South Africa is the country of big game, big distances, and big things generally, so that very small creatures such as Rotifera have a poor chance of being noticed, and, indeed, seem to have been almost entirely neglected or passed over by naturalists, travellers, and by the Afrikanders themselves—possibly because they do not afford sufficient sport for shooting, or for the line, or because they do not possess skins, or carry horns or tusks which might be nailed on the wall as trophies. And yet the Rotifera form a not inconsiderable part of the fauna of that vast country.

The very first mention of a Rotifer in South Africa, as far as I can discover, is contained in a paper published in 1891 by Fleet-Surgeon V. Gunson Thorpe, R.N. (19),* describing a new species,

* The numbers in brackets refer to the Bibliography at the end.

EXPLANATION OF PLATE XIV.

Fig. 1.—*Brachionus furculatus* Thorpe. × 130.
„ 2.— „ „ „ Variety with only one posterior spine. × 130.
„ 3.— „ „ „ Variety with reduced spines. × 130.
„ 4.— „ „ var. *inermis* Rousselet. × 150.
„ 5.— „ „ Thorpe. Lorica of male, dorsal side. × 180.
„ 5a.— „ „ „ „ „ ventral side. × 180.
„ 6.—*Cathypna leontina* Turner. × 250.

Brachionus furculatus, found by him in a pool near Simons Bay, Cape of Good Hope. Then in 1893 the same author, in a short note on the "Recorded Localities for Rotifera" (20), mentions the following additional six species observed by him in South Africa—

Philodina citrina Ehrbg.	Cape of Good Hope.	
Brachionus pala Ehrbg.	„	„
„ *dorcas* Gosse	„	„
„ *urceolaris* Ehrbg.	„	„
„ *angularis* Gosse	„	„
Metopidia solidus.	Delagoa Bay.	

In 1901 the Hon. Thomas Kirkman, of Natal, published in this Journal a "List of some of the Rotifera of Natal" (11), in which 52 species are enumerated for that Colony, and quite recently the same author has sent a "Second List of Natal Rotifera" (12) to this Society, containing 21 additional species.

Lastly, Mr. Wm. Milne, of Cape Colony, published in 1905 a short paper with notes on "Some New South African Floscules" (15), mentioning seven species. This is the sum total of the published accounts of South African Rotifera. Within the last few months Mr. Milne has, at my request, sent me a list of species which he has observed in his district of Uitenhage, and which I have incorporated in the general list of South African species given at the end of this paper.

The visit of the British Association for the Advancement of Science to South Africa in the autumn of last year afforded me a welcome opportunity of visiting this interesting country, and of making collections of Rotifera in various and widely separated parts, the results of which are embodied in this paper. I may state at once, however, that several circumstances prevented my searching for and collecting as much as I should have desired, so that my results can only be taken as a small contribution to the Rotiferous fauna of these vast regions. In the first place, the time of our arrival in South Africa, August, corresponds with the early spring, when no rain has fallen for many months, and the whole country, except only the south and west coast district, is very dry—all pools, ponds, and even rivers, in the interior are dried up. It was not easy to find suitable collecting grounds, as we visited no lakes or large pieces of water. In the second place, we rushed through the country at a great rate in order to get through the pre-arranged programme on the appointed days, from Capetown to Durban, and from Durban to the Zambesi and Beira, a distance of over 4500 miles, stopping only very few days at the principal towns. Then on arrival anywhere, every hour of the day had been set apart for some function, reception, luncheon, lecture, or visit to battlefields and places of interest. An umbrella being quite unnecessary at

this rainless season, I carried my collecting stick everywhere with me, and the net, with bottle attached, in my pocket, so as to be able to take advantage of every opportunity that might present itself.

From August 18 to September 17 the greater part of the time was spent in the railway train, which formed our travelling hotel and headquarters, only getting off and staying a few days at Durban, Pietermaritzburg, Johannesburg, Bloemfontein, Kimberley, Bulawayo and Victoria Falls, and a few hours at Salisbury, Umtali and Beira, being everywhere received with the greatest hospitality. I had taken with me a small folding binocular Microscope, but examination of the living material was quite out of the question, as there was absolutely no time or opportunity of doing so, and therefore I preserved the collected material mostly in the train in the following manner. After condensing the Rotifera as much as possible with the net in the usual way, I filled a somewhat tall 3-ounce bottle and added a little 2½ p.c. formalin and a very few drops of osmic acid; this killed all the animals and sent them to the bottom; after allowing the bottle to stand for half-an-hour, I carefully poured away the clear upper part of the water, and then transferred the remainder with sediment into a smaller bottle, adding again a little of the formalin. When the animals and debris had again settled at the bottom, the subjacent water poured away or removed with a pipette, I filled a small tube bottle with the remainder, and after allowing this to settle once more for half-an-hour I removed half of the clear water with a pipette and filled up the tube bottle with 2½ p.c. formalin; thus the contents were finally preserved in about 1 p.c. formalin for examination at home.

As this rough method of preservation, the only one available under the circumstances, has given fairly good results, I have described it in detail; of course all the Rotifers are fully contracted, but all the forms could readily be identified, and the shape of the loricated forms is well preserved. In the absence of osmic acid, formalin alone, or even alcohol, might be used in the same way. It would, however, be preferable, if time permitted, to narcotise the Rotifers first with a few drops of 1 p.c. solution of β Eucaine for a quarter of an hour before killing.

The different localities where I was able to collect being situated in widely separated areas, hundreds of miles apart, I will give a separate list of the species found in each locality, which may be useful to future collectors in the same districts.

Capetown afforded but a poor opportunity of searching for Rotifers; the four days we stayed there were spent in attending to the meetings and business of the British Association, and in viewing this beautiful town and country around. Unfortunately, I discovered too late, after I had climbed 3000 feet to the top of

Table Mountain without my net, that the Capetown water supply is derived from two large reservoirs which have been constructed on the top of the mountain. Having lost my way, and seeing the lake in the distance, I went to a small house near it where I found the keeper, a Dane, who told me that he had lived there with his family in charge of the reservoirs eleven years, and that often in the winter he was snowed up for ten days or a fortnight at a time. Every cloud that passes over Capetown settles on Table Mountain and forms the "Table Cloth"; in consequence of this the plateau and valleys on the top of the mountain are very moist, and covered with vegetation, heathers and brushwood, and I even saw some extensive bogs there from which, no doubt, the Capetown water derives its slightly brownish tint. From the lakes the water is led by iron pipes into lower reservoirs at the foot of Table Mountain and on the highest ground of the town. One of these is situated close behind the Mount Nelson Hotel, and from it I obtained—

Synchæta pectinata Ehrbg. Abundant.
Anuræa aculeata var. *valga* Ehrbg. Few.

Cladocera were very abundant in this water, and their lively movements astonished the keepers, who informed me that this water was delivered to the town without further filtration.

In the garden fountain of the Mount Nelson Hotel I found only—

Anuræa hypelasma Gosse;

and on the top of Signal Hill, a short distance behind the signal station, from a small cattle-pond I obtained—

Hydatina senta Ehrbg. Abundant.
Brachionus Bakeri Ehrbg. Abundant.
Callidina sp.?

These rather small *B. Bakeri* vary from the common European form, in having the posterior spines of the lorica turned more or less upwards. The same pond contained a large ciliated Infusorian, in shape like a three-pronged arrow-head, which I believe to be new. The above six species were the only Rotifers observed at Capetown, but I am quite sure that a much greater number could have been found had I had more time and better opportunities. The large ornamental basin in the Public Gardens had just been emptied when I arrived with my net to examine the water, so that I lost this opportunity.

Leaving Capetown on the Friday evening, August 18, by train, I arrived in Durban on the following Tuesday morning, August 22, without stopping more than half an hour at any place on the way.

As the Hon. Thomas Kirkman has been, and still is, working at the Rotifera of Natal, I made no collections either at Durban or Pietermaritzburg, preferring to leave this field entirely to him, and he has since then sent in a second list of Natal Rotifers, which has been read at our last meeting (7).

After visiting Colenso and Ladysmith, we journeyed to Johannesburg, arriving there on August 28, where we were most hospitably entertained by the inhabitants, and a large number of papers were read in the various sections during our five days' stay. Here I endeavoured with but little success to find suitable pools or reservoirs of water. I went to a large reservoir of clear water, triangular in shape, walled up on two sides, which, I think, must have been near the City and Suburban Gold Mine. I examined the water in various places, but could see no living creature in it of any kind; looking round, I saw various mountains of white sand from the mines, and, considering that all these refuse heaps had been treated with cyanide of potassium, and that the rainwater flowing down their sides runs into the spruit which feeds this reservoir, it was not difficult to account for the absence of all animal life in the water. I also tried to reach a town-water reservoir, situated on high ground in the north-east district, but it was closed all round, so that I could not get at the water. Finally, my host kindly sent me for a long drive through the northern suburbs, where I came to a spruit and a farm with a small reservoir of water, and here I found the following species of Rotifers—

Synchæta pectinata Ehrbg.
Copeus cerberus Gosse.
Hydatina senta Ehrbg.
Euchlanis oropha Gosse.
Metopidia lepadella Ehrbg.

August 31 was set aside for an excursion to Pretoria, and there, in the grounds of the Zoological Gardens, I found the aquatic birds' pond quite green with *Euglena viridis*, and from its water obtained the following species of Rotifers—

Brachionus pala Ehrbg. Abundant.
,, *furculatus* Thorpe. Abundant.
Metopidia rhomboides Gosse.

Brachionus furculatus was a most interesting find, as this large species had not been seen since Fleet-Surgeon Gunson Thorpe (19) first discovered it in Simons Bay in 1890, and it has not yet been recorded from any place outside South Africa. The male was also present in abundance, and I can confirm Surgeon Thorpe's statement that the male has a distinct lorica, spineless, much smaller

and different in shape to that of the female (Pl. XIV. fig. 5). All other known *Brachionus* males are soft bodied, without lorica. The greatest characteristic peculiarity of this species is that the glassy transparent lorica of the female (Pl. XIV. fig. 1) has the two outermost of the six occipital spines greatly prolonged, and further, has two large more or less curved latero-posterior spines. I also found in the water the variety already noted by Surgeon Thorpe, in which the posterior spines are wholly wanting, and the latero-anterior spines reduced in size. The difference in appearance of the two varieties is very striking, and yet they seem to belong to one species, as intermediate forms are found, and even some with only one posterior spine on the left side (Pl. XIV. figs. 2, 3). I cannot, however, agree with Surgeon Thorpe's statement that the posterior spines are shed when adult life is reached, for I have seen numerous very young specimens of both varieties, showing that each of them reproduce their own kind; this being so, it will be best to distinguish this spineless variety by a distinctive name, and I propose to call it *Brachionus furculatus* var. *inermis* n. var. (Pl. XIV. fig. 4).

Subsequently I found rather larger specimens of this species in two places in the Orange River Colony, as mentioned below. Although there is a distant resemblance to *B. Bakeri* and might be confounded with it, *B. furculatus* does not belong to the *B. Bakeri* group, the structure of the lorica being of a different type.

The sizes of the largest specimens are as follows: Over all, including posterior spines, 578 μ ($\frac{1}{44}$ in.), without posterior spines, 340 μ ($\frac{1}{75}$ in.); greatest width, 265 μ ($\frac{1}{96}$ in.); the female egg, 142 μ by 105 μ ($\frac{1}{180}$ by $\frac{1}{242}$ in.); lorica of male, 142 μ ($\frac{1}{180}$ in.); var. "*inermis*," length 272 μ ($\frac{1}{93}$ in.), width 204 μ ($\frac{1}{125}$ in.).

Pl. XIV., figs. 1–5, shows this species and its varieties.

From Johannesburg we travelled to Bloemfontein; the Bloemspruit which traverses the town was dry, and was being excavated and regulated to prevent the repetition of dangerous floods during the rainy season. On September 3 a day excursion to visit the Government Experimental and Stud Farm at Tweespruit, some 58 miles east of Bloemfontein near the Basutoland border, enabled me to make some good collections of Rotifers. Our train stopped for twenty minutes at Sannah's Post, celebrated through the disastrous Boer surprise attack on an unsuspecting British column on the march in the late war, when seven guns were lost. The Boers were hidden in the dry bed of the Koorn Spruit, a small rivulet and tributary to the Modder river, excavated by water in the level plain and quite invisible at twenty yards' distance. At the spot where the column intended to cross the spruit and where the fight took place I saw a pool of water in the river bed, which I examined, and found it swarming with Rotifers, water-fleas and pond life generally; I secured a bottle-full of the condensed water and

afterwards obtained therefrom the following ten species of Rotifers—

Brachionus furculatus Thorpe. ♂ and ♀ abundant.
" " var. *inermis* Rousselet. Abundant.
" *quadratus* Rousselet. Few.
" *angularis* Gosse. Few.
Synchæta pectinata Ehrbg. Abundant.
" *tremula* Ehrbg. Few.
Polyarthra platyptera Ehrbg. Very abundant.
Triarthra longiseta Ehrbg. Abundant.
Anuræa aculeata var. *valga* Ehrbg. Abundant.
" *cochlearis* Gosse. Few.

The Tweespruit is a small rivulet which runs through the grounds of the Government Experimental Farm some miles beyond Thaba Nchu, and is a tributary to the Caledon river. It had been dammed up at one spot, but the dam had been damaged and partly washed away; still a large pool of water was left, and from this I obtained the following species of Rotifers—

Brachionus furculatus Thorpe. ♂ and ♀ abundant.
" " var. *inermis* Rousselet. Abundant
" *quadratus* Rousselet.
" *angularis* Gosse.
Synchæta pectinata Ehrbg.
Euchlanis oropha Gosse.
Cathypna luna Ehrbg.
Anuræa aculeata var. *valga* Ehrbg.

In both these localities *B. furculatus* was very abundant and the specimens much larger in size than those found at Pretoria. The var. *inermis* and the males were also plentiful. The other kinds show no difference from the same European species, except perhaps that the posterior spines of *Anuræa aculeata* var. *valga* are somewhat larger than usual.

Our next stopping place after twenty-four hours' railway journey was Kimberley, more celebrated for its diamonds than for its Rotifers. We crossed the Orange River three times on our journey, and I much regretted not to be able to collect in the pools of water which I could see in the river bed when crossing the bridges; a flow of water was scarcely perceptible. Kimberley is a notoriously dry place, and formerly, in the early days of diamond digging, four shillings were paid for a cask of water. At the diamond mines the water used for washing the blue diamontiferous ground is pumped up from the deep workings, collected in settling tanks, and used over and over again. The only suitable pool or lake I could find here was one at Alexanderfontein, a pleasure resort some six miles

out, which is reached by an electric tram. Here there is an ornamental lake in the gardens of the hotel, and therefrom I obtained six species of Rotifers—

Polyarthra platyptera Ehrbg. Very abundant.
Euchlanis oropha Gosse. Few.
Diaschiza gibba Ehrbg. Few.
Cathypna luna Ehrbg. Few.
Pterodina patina Ehrbg. Abundant.
Brachionus Bakeri Ehrbg. Abundant.

On the afternoon of September 7 we left Kimberley for Bulawayo, and after a long journey through the very dry and more or less desert country of Bechuanaland reached our destination on the morning of the 9th. There was no opportunity for collecting during this journey, though I might probably have been successful had I known then that it is possible to collect Rotifers by the hose which feeds the engine from the iron or wooden railway water-tanks at the stations, a discovery which I made later in Rhodesia.

Bulawayo is an embryo city, a town of magnificent distances, which stands in an open plain where fifteen years ago some bushes and a few blades of grass only grew. The plan of the town, with its broad avenues and streets, looks imposing, but a closer acquaintance reveals the fact that only the central business part is covered with a fair number of substantial houses, with a building here and there at the corners of streets; the remainder are blank stands or numbered plots of land to let, awaiting tenants. The town, however, has six hotels, three clubs, five churches, a public library and a Natural History Museum, which was opened during our visit by Professor Darwin; so there can be no doubt that it will grow in extent and prosperity as time goes on. A small stream called Matjesumshlope river runs through a portion of the town set apart for a large park, but at the time of our stay it had ceased running, and presented a very dry bed of sand. My search for a pond or pool of water at this dry season was altogether hopeless, so I turned my attention to the waterworks of the town. The water supply of Bulawayo is drawn from a series of reservoirs formed by damming several breaks in a natural chain of granite kopjes some three miles to the east of the town. Unfortunately I had no opportunity of visiting these reservoirs, but the water is brought to the town by a main flowing into a large tank situated close to the station; from here it is pumped through a filter and distributed in

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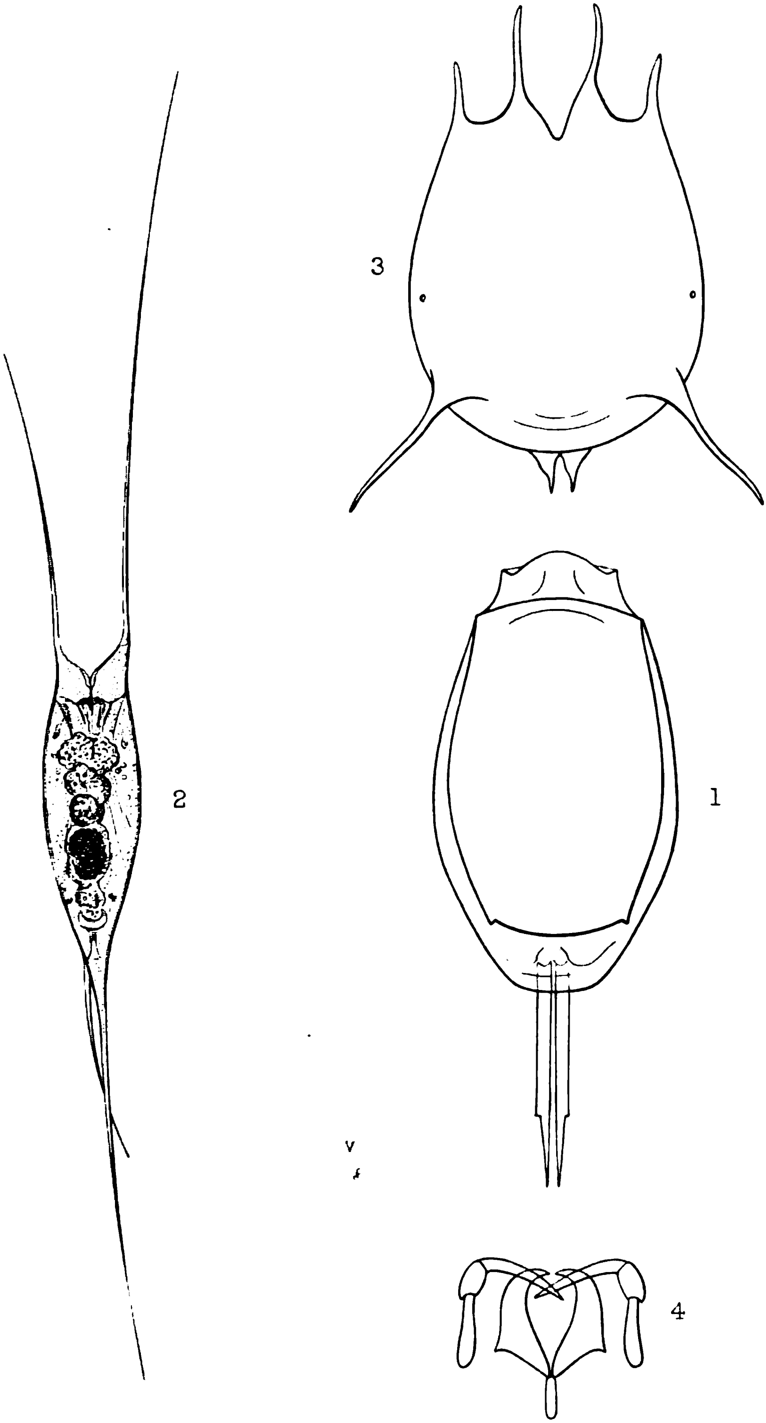
EXPLANATION OF PLATE XV.

Fig. 1.—*Cathypna ungulata* Gosse. × 225.
„ 2.—*Tetramastix opoliensis* Zacharias. × 210.
„ 3.—*Brachionus pala* var. *dorcas*. × 160.
„ 4.—Jaws of unnamed Notommatoid Rotifer from Victoria Falls. × 250.



F R Dixon-Nuttall del ad nat. West, Newman lith

South African Rotifers

the town. The water in this tank was coloured green by a minute alga, *Microcystis æroginosa*, and in the sample I brought away I afterwards found the following five species of Rotifers—

Conochilus dossuarius Hudson. Abundant.
Brachionus pala var. *dorcas* Gosse. Abundant.
„ *angularis* var. *caudatus* Barrois and Daday.
Anuræa aculeata var. *valga* Ehrbg.
„ *cochlearis* (*forma micracantha*) Gosse–Lauterborn.

The *B. pala* var. *dorcas* found here is remarkable for very long and very narrow anterior and posterior spines, as represented in Pl. XV. fig. 3, the European species having rarely posterior spines.

B. angularis var. *caudatus* is a variety not yet found in England, but described by Barrois and Daday from Syria (2); the posterior protuberances guarding the opening of the foot are here prolonged into slightly diverging spines of considerable length.

One day of our stay at Bulawayo was devoted to an excursion to the "World's View," a rounded granite mountain in the Matoppo Hills, where Cecil Rhodes's grave is situated, and commanding a grand view of a magnificent series of hills formed of huge and fantastic granite blocks and masses of rock. A branch line of the Rhodesian Railway brought us within six miles of the "World's View," and close to the railway terminus a large and comfortable hotel has been built, a kind of sanatorium where a very enjoyable holiday could be spent. The country here is no longer so dry, and streamlets with running water could be seen in various directions, also farms and herds of cattle. From the hotel to the foot of the "World's View" we were driven by brakes, stage-coaches, hunting-cars, twenty-one in number, of various degrees of antiquity, drawn by eight and ten mules each, over a sandy and bumpy road, through a grassy plain first, then through a narrow valley flanked by granite rocks and ridges. A novel experience here was the encounter with a large swarm of red locusts, which rose in millions like a cloud. At the spot where the carriages were out-spanned a streamlet with a fair amount of clear water formed pools here and there, and a bog at one place, where I saw a number of the Sundew, *Drossera*, growing and in flower. I tried various of these pools, but could see nothing more than a few Infusorians, in particular a bright red *Stentor*, in the water, and so took no sample. My subsequent experience has taught me that it is better to condense and preserve a sample of any such water, as Rotifers are sure to be found in the sediment when carefully examined later on at home. On our return journey I stopped the carriage when it was crossing a streamlet which formed a pool by the wayside, jumped off, passed my net quickly through the water a number of times, and jumped on again—all done in less than two minutes. When I examined

this preserved material at home the following ten species of Rotifers were found—

Triarthra longiseta Ehrbg. Few.
Diurella stylata Eyferth. „
Metopidia oxysternum Gosse. „
Tetramastix opoliensis Zacharias. Three specimens.
Pompholyx complanata Gosse. Many.
Brachionus pala var. *dorcas* Gosse. Abundant.
„ *angularis* Gosse. Few.
Anuræa aculeata var. *valga* Ehrbg. Many.
„ *cochlearis* (*forma micracantha*) Gosse–Lauterborn.
Pedalion mirum Hudson. Abundant.

It was interesting to come across *Pedalion mirum* in this locality, but the most extraordinary find was *Tetramastix opoliensis*, a species which I had never yet seen, and which has, as far as I know, only been found once before by Dr. Zacharias in 1897 (25), who discovered it in preserved plankton material from the Oder, near Oppeln, in Upper Silesia, Germany. The loricate body is elongate, spindle-shaped, slightly compressed laterally, with two long anterior and two posterior spines of unequal sizes. The two anterior spines are similar in shape, both starting from a triangular base, and diverging, but the right spine is nearly twice as long as that on the left side. Posteriorly the large spine is median, dorsal in position, and much stouter at its base than the shorter and ventrally situated spine; these two spines originate close together, dorso-ventrally (not side by side, laterally, as figured by Dr. Zacharias), and run parallel to each other. One specimen carried an egg, attached posteriorly to the ventral side. Dr. Zacharias figures a large median eye, but no eye can be detected in my contracted and mounted specimens. Pl. XV. fig. 2, is a good representation of this animal drawn by Mr. F. R. Dixon-Nuttall.

The following sizes were obtained from my largest specimen: size of body alone, 204 μ ($\frac{1}{125}$ in.); of large anterior spine, 374 μ ($\frac{1}{68}$ in.); of large posterior spine, 272 μ ($\frac{1}{93}$ in.); total, 850 μ ($\frac{1}{30}$ in.).

All I could do at the time of collecting was to preserve the material in formalin, without even looking at it, so that this Rotifer has never yet been seen or examined in the living state, and its mode of progression through the water is not known, though it may fairly be guessed that it swims in similar fashion to *Notholca longispina*.

On the Monday morning, September 11, we started in our special trains for the Victoria Falls, situated at a distance of 282 miles north-west of Bulawayo. Travelling through a forest region, in which the trees were without foliage, having learned to shed their leaves during the dry season, though the temperature was quite warm, we reached a station called Igusi, I think, where the

railway crosses a river of the name of Amgusi. A small engine by the side of the railway pumps water from the river into a large elevated iron tank for feeding the locomotives. After our engine had had her fill I put my net under the hose, and the engineer allowed the water to run through for a few minutes. With the hand-glass I could see a few Rotifers swimming about in the bottle, so I preserved the material, and afterwards found the following nine species in the tube thus collected—

Philodina ? sp. With two teeth in jaw.
Synchæta pectinata Ehrbg.
Copeus Ehrenbergi Ehrbg.–Gosse.
Polyarthra platyptera Ehrbg.
Euchlanis oropha Gosse.
Dinocharis tetractis Ehrbg.
Monostyla lunaris Ehrbg.
„ *bulla* Gosse.
Metopidia solidus Gosse.

The large *Copeus Ehrenbergi* (that is, Ehrenberg's *Notommata Copeus* and Gosse's *Copeus labiatus*, which are certainly synonyms) seems to have a wide distribution in South Africa, and over the world generally. It is well known that this species has a thick, very transparent, gelatinous covering, closely adherent to the integument, which often can be seen only by a very good dark ground illumination. In the present preserved specimen, the gelatinous envelope seems to have been dissolved away, disclosing numerous fine, short, stiff hairs all over the ventral and dorsal surface of the body. This is a most unusual condition of the exterior integument of a Rotifer, and it may be that these hairs, which have not been noticed before, either secrete the gelatinous envelope, or are instrumental in keeping it in position, being themselves invisible when immersed in the gelatinous substance. This is a point which will require further investigation.

Continuing our journey, the next place I was able to collect at was a station beyond Gwaai, where a stream forms a rather shallow pool close to the station. Here I obtained a large spherical alga, allied to *Volvox globator*, which proves to be a new species and will be described elsewhere. The Rotifers found in this pool are the following seven species—

Lacinularia elliptica Shephard.
Megalotrocha spinosa Thorpe.
Euchlanis oropha Gosse.
Pterodina patina Ehrbg.
Anuræa aculeata var. *valga* Ehrbg.
„ „ „ *curvicornis* Ehrbg.
„ *cochlearis* Gosse.

Megalotrocha spinosa was first discovered in China by Fleet-Surgeon Gunson Thorpe (20), and has since been found in various parts of the world, but not in England.

Lacinularia elliptica forms free-swimming colonies of elliptical shape, the animals being fixed round a short, straight axis; it was first discovered in 1896 by Mr. John Shephard (16) in Victoria, Australia; two years ago I found some specimens in a gathering sent to me by Mr. R. H. Thomas from the Salisbury district in Rhodesia. This species has not been recorded from any other country so far. A closely allied species, also forming elliptical and free-swimming colonies, but differing in some anatomical details of the animals, *L. racemovata* of Gunson Thorpe, is known from China.

The remainder of the journey to the Zambesi through the Wankie coal district was performed at night, so that there was no further opportunity of collecting. Our train reached the Victoria Falls station before daybreak, at about 5 o'clock in the morning of September 12, and that and the following day were spent in exploring these wonderful Falls, about a mile and a quarter (or more exactly 1936 yards) in width and about 350 to 400 feet deep, and the extraordinary gorges which the water has excavated in the basaltic rocks. At this time of year, towards the end of the dry season, the water of the Zambesi was low, and we were enabled to visit Livingstone Island, situated right on the edge of the Falls and about midway between the two shores.

Owing to the perfectly horizontal formation of the rocks in this region the Zambesi above the Falls is a very broad, shallow, lake-like river, dotted with wooded islands and without rapids or appreciable current. After crossing the new railway bridge, 635 feet long, which spans the gorge a few hundred yards below the Falls and 400 feet above the water, we walked to a point about half-a-mile above the cataract on the north side of the river and were taken by natives in small boats to Livingstone Island, where Dr. Livingstone landed just fifty years earlier and first saw the great sight. This island is covered with trees, and at low water the rocks of the river bed on the north side are exposed and form shallow pools. From these pools I collected with my net and preserved the material without a chance of looking at it on the spot. On examination of the contents of the little bottle after my return home I was glad to find it exceptionally rich in Rotifers, yielding 32 different species, as follows—

Floscularia ? sp. A small contracted specimen.
Megalotrocha spinosa Thorpe.
Callidina ? sp. With two teeth in jaws.
Synchæta oblonga Ehrbg.
Triarthra longiseta „

Notommata naias Ehrbg.
Copeus Ehrenbergi Ehrbg.–Gosse.
„ *pachyurus* Gosse.
Proales daphnicola Thompson.
Diglena forcipata Ehrbg.
Rattulus mucosus Stokes.
Dinocharis tetractis Ehrbg.
Polychætus Collinsi Gosse.
Diaschiza gibba Ehrbg.
„ *exigua* Gosse.
Salpina eustala Gosse.
Euchlanis oropha Gosse.
„ *triquetra* Ehrbg.
Cathypna luna Ehrbg.
„ *rusticula* Gosse.
„ *leontina* Turner.
„ *ungulata* Gosse.
Monostyla bulla Gosse.
„ *lunaris* Ehrbg.
Colurus (Monura) bartonia Gosse.
Brachionus militaris Ehrbg.
„ *angularis* Gosse.
„ „ var. *caudatus* Barrois and Daday.
Anuræa aculeata var. *valga* Ehrbg.
„ *cochlearis* (*forma micracantha*) Gosse–Lauterborn.
„ „ var. *tecta* Gosse.
„ *hypelasma* Gosse.

Considering that the rock-pools in which these Rotifers were found are situated only two to twenty yards from the edge of the great Falls, and that for a period of six months, during and after the rainy season, they are being washed by a volume of water six to ten feet thick, it is truly astonishing to find this abundance and variety of Rotatorian life in this situation. The pools are mostly connected by small channels with the stream, so that a few yards' excursion in the wrong direction would bring any one of these Rotifers into the slow current of the flowing water, which in a few minutes would carry it over the precipice into the great chasm below.

This list contains some interesting forms which are rare in England, or have not yet been found here at all. *Polychætus* (*Dinocharis*) *Collinsi* is an uncommon Rotifer, with lorica well protected by four long spines on the back and six smaller spines posteriorly. *Rattulus mucosus* is an American species not yet recorded in England. *Cathypna leontina* (Pl. XIV. fig. 6) was discovered by Turner (22) in 1892, and has been found in various places in North America, and also reported by Professor von

Daday from Paraguay in South America (3), and by Dr. Levander in Finland, under the name of *C. appendiculata* (13). The size of my specimen is 254 μ ($\frac{1}{100}$ in.), inclusive of toes. *Cathypna ungulata* was described by Gosse, but is very rare in England. I have found it only once at Woking, and it has been reported from America by Professor Jennings (9), and from Germany by Bilfinger (1). This is perhaps the largest known *Cathypna*, measuring 258 μ the lorica alone, the toes 104 μ, giving a total length of 362 μ ($\frac{1}{70}$ in.). The toes are narrow and long, and shouldered on the outer side at one-third of their length, producing very long, acute claws. As Mr. Gosse has not published a complete figure of this animal in the "Supplement" to the Monograph (7), I give here a drawing of the lorica made by Mr. F. R. Dixon-Nuttall, by means of which it will be more readily recognised (Pl. XV. fig. 1).

After returning to the north bank of the Zambesi, I walked some little distance along the stream, which is here overgrown with reeds and other vegetation. In a small bay of the river where there was no perceptible flow of water I filled a bottle with condensed water which looked very rich in Desmids and Rotifera. From this I afterwards obtained the following 24 species—

Limmias ceratophylli Schrank.
Actinurus neptunius Ehrbg.
Synchæta oblonga Ehrbg.
Triarthra longiseta Ehrbg.
Diglena forcipata Ehrbg.
Rattulus pusillus Lauterborn.
„ *mucosus* Stokes.
Dinocharis tetractis Ehrbg.
Polychætus Collinsi Gosse.
Diaschiza gibba Ehrbg.
Salpina eustala Gosse.
Euchlanis oropha Gosse.
Cathypna luna Ehrbg.
„ *leontina* Turner.
„ *ungulata* Gosse.
Monostyla lunaris Ehrbg.
„ *bulla* Gosse.
Metopidia solidus Gosse.
Pterodina patina Ehrbg.
Pompholyx complanata Gosse.
Brachionus angularis var. *caudatus* Barrois and Daday.
Anuræa cochlearis var. *hispida* Lauterborn.
„ „ (*forma robusta*) Gosse–Lauterborn.
„ *aculeata* var. *valga* Ehrbg.

These two lists, containing 38 different species, being the result of the first and very inadequate exploration of the Zambesi river, show that this great stream has a rich Rotatorian fauna. The species of this remote region, with a single exception, are all identical with known forms from Europe and other parts of the world, and this fact corroborates in a remarkable way the very wide and uniform distribution of the Rotifera.

The single exception is a soft-bodied Notommatoid Rotifer, possibly of the genus *Pleurotrocha*, having a large cervical eye, ample and folded foot, cylindrical toes of fair size, and jaws which are unlike those of any species I am acquainted with. The two specimens found are, however, so inadequately preserved that it is impossible to give a sufficient drawing and description, and so I prefer to leave it unnamed at present, merely reproducing my drawing of the characteristic jaws (Pl. XV. fig. 4).

All the *Anuræa* of the Zambesi have this peculiarity, that the facets of the lorica are almost wholly obliterated, and replaced in the varieties of *A. cochlearis* by very fine stipples, uniformly spread all over the surface, thus corresponding to Lauterborn's var. *hispida*; the variety which I call "*robusta*," after Lauterborn (14), possesses a very stout, short spine, broad at the base, but only a faint keel ridge, bifurcating anteriorly, otherwise it is finely stippled like *hispida*, and entirely free from facets. *Anuræa aculeata* var. *valga* has a shell of glassy transparency without a trace of facets or stipples. Nowhere else in South Africa or Europe have I seen this peculiarity in *Anuræa*.

My collections from the Zambesi contained also numerous Desmids and Diatoms, and Mr. W. West has enumerated 21 species on two slides which I made.

On the following morning, September 13, I explored the rock-pools in the river bed on the south shore, close above the Falls, and found a new fresh-water Sponge adhering to the under-surface of stones, which has since been described by Mr. R. Kirkpatrick before the Zoological Society under the name of *Spongilla Rousseleti*. I also captured here a blue fresh-water crab of the genus *Telfusa* or *Potamon*.

In the afternoon of the same day we started on our return journey, reaching Bulawayo next morning, and starting again the same evening for Salisbury and Beira. No opportunity for collecting occurred on the journey through Mashonaland, the stoppages at stations being very short. Wishing, however, to bring back something from this part of the country, when we arrived at Norton Station, an hour and a half before reaching Salisbury, I put my net under the hose which had been feeding the engine and allowed the water from the railway water-tank to run through it for five minutes; in this way I obtained a tube of material in

which I could see some Rotifers swimming about, and which was afterwards found to contain the following 16 species—

Conochiloides (*conochilus*) *natans* Seligo-Hlava.
Triarthra longiseta Ehrbg. Very abundant.
Copeus Ehrenbergi Ehrbg.
Diurella stylata Eyferth.
Dinocharis tetractis Ehrbg.
Euchlanis triquetra Ehrbg.
„ *oropha* Gosse.
Distyla flexilis Gosse.
Monostyla bulla Gosse.
Plœsoma lenticulare Herrick.
Brachionus Bakeri Ehrbg.
„ *angularis* Gosse.
Anuræa aculeata var. *valga* Ehrbg.
„ „ var. *curvicornis* Ehrbg.
„ *cochlearis* (*forma micracantha*) Gosse-Lauterborn.
„ „ var. *tecta* Gosse.

This water also contains numerous Desmids and Diatoms, and Mr. William West has enumerated 24 species in one slide of the material. It is worth noting that a railway water-tank in South Africa, and probably also elsewhere, can contain such an abundance of pond life. I afterwards learned that this water was pumped up from the Hunyani river.

Among the above Rotifers are two rare forms: *Conochiloides natans*, first discovered by Seligo (17) in 1900, in the Stuhmer Lakes near Danzig, and afterwards found by M. Voigt (23) near Ploen, and by St. Hlava (5) in Bohemia. *Plœsoma lenticulare* is very rare; first found in Lake Erie, in America, by Vorce in 1882, and named by Herrick in 1885 (4), it has been recorded by Jaegerskiöld, 1892, in Sweden (8), by Wierzejsky, 1892, in Galicia (24), by Levander (13) and Stenroos (18), 1895, in Finland, and by John Hood, 1894, in Ireland (6), who has published the best figure of this species. It is therefore remarkable to have obtained these two rare forms from a railway tank in the interior of South Africa.

During the further progress of our journey, we stayed six hours at Salisbury, and half a day at Umtali, but I had no opportunity of collecting at those places. The following day, September 17, we reached Beira, and after a very hospitable reception by the Portuguese Governor and authorities, and luncheon in the Custom House buildings, we embarked on board the 'Durham Castle,' which was waiting for us in the harbour, and brought us safely home viâ the East Coast of Africa, with stoppages at Mozambique, Mombasa, and Egypt.

The subjoined list of all South African Rotifers, as far as known at present, contains 156 species. Their distribution in the various Colonies is as follows: Cape Colony, 91 species; Orange River Colony, 12 species; Transvaal, 9 species; Natal, 73 species; Rhodesia, 54 species.

Mr. Wm. Milne's list for the Uitenhage district of Cape Colony is shown in a separate column, 2.

In glancing over this list, one cannot but be struck with the remarkable world-wide distribution of so many of these minute, but highly organised, creatures, with identical shapes, markings, spines, and other features. The best explanation is that the Rotifera, in addition to thin-shelled summer eggs which hatch at once, produce resting eggs with thick, tough shells, capable of withstanding any amount of desiccation, and which may be wafted up with the dust of dried-up pools, and carried very long distances by the wind and air currents, and thus scattered over the whole surface of the earth, and then come to life and reproduce their kind whenever they happen to fall on a spot suitable for their existence. There are, no doubt, other modes of distribution, such as the agency of aquatic birds, but the above, I think, is the principal one, and the only one that can satisfactorily account for the existence of so many identical species in Europe, America, China, India, Australia, and Africa.

This list of South African Rotifers is also remarkable for the total absence of a few prominent groups, such, for instance, as the Asplanchnas, which are very abundant in many places in Europe, and being large and readily captured with other plankton, could not be missed if present.

Then the case of *Anuræa aculeata* is most peculiar. This is a very common, and often enormously abundant, species in Europe and other countries, but in South Africa I did not come across it once, although the closely allied variety "*valga*," which differs only in having a shorter posterior spine on the left side, is present in nearly all my collections in the Orange River Colony and Rhodesia.

I may add here that on the way out, from Madeira to Capetown, and also on the East Coast from Beira to Suez and Marseilles, I made daily collections of plankton from the sea by allowing the water, which is pumped up every morning for the purpose of washing the decks and delivered by the hose, to run through my net for about an hour. In this way I obtained an abundance of living marine creatures, mostly Infusoria, Copepods, larval worms, diatoms, etc., but only once did I find a Rotifer, namely, *Synchæta vorax* Rouss., in the Bitter Lake of the Suez Canal.

DISTRIBUTION OF ROTIFERA IN SOUTH AFRICA.

	Cape Colony.	Cape Colony; Wm. Milne's List.	Orange River Colony.	Transvaal.	Natal.	Rhodesia.
RHIZOTA.						
Floscularia cornuta Dobie		×			×	
" *coronetta* Cubitt		×			×	
" *ornata* Ehrbg.		×			×	
" *campanulata* Dobie		×				
" *ambigua* Hudson		×				
" *regalis* Hudson		×				
" *annulata* Hood		×				
" *moselii* Milne		×				
" *sessilis* Milne		×				
" *minuta* Milne		×				
Oecistes crystallinus Ehrbg.		×				
" *ptygura* Ehrbg		×				
" *longicornis* Davis					×	
" *velatus* Gosse		×				
" *pilula* Wills		×				
Conochiloides dossuarius Hudson-Hlava						×
" *natans* Seligo-Hlava						×
Melicerta ringens Schrank		×			×	
Limnias ceratophylli Schrank		×			×	×
" *annulatus* Bailey					×	
" *myriophylli*		×				
Cephalosiphon limnias Ehrbg.					×	
Lacinularia socialis Ehrbg.		×			×	
" *elliptica* Shephard						×
Megalotrocha semi-bullata Hudson		×			×	
" *spinosa* Thorpe						×
BDELLOIDA.						
Philodina erythrophthalma Ehrbg.					×	
" *roseola* Ehrbg.					×	
" *macrostyla* Ehrbg.		×				
" *megalotrocha* Ehrbg.		×			×	
" *aculeata* Ehrbg.		×				
" *citrina* Ehrbg.		×				
Rotifer vulgaris Schrank		×			×	
" *macrurus* Schrank					×	
" *tardus* Ehrbg.		×			×	
" *megaceros* Gosse		×				
Actinurus neptunius Ehrbg.		×			×	×
Callidina (Macrotrachela) elegans Ehrbg.		×				
Adineta vaga Davis		×				
PLOÏMA. IL-LORICATA.						
Sacculus viridis Gosse		×				
Synchaeta pectinata Ehrbg.	×		×	×	×	×
" *tremula* Ehrbg.			×		×	

DISTRIBUTION OF ROTIFERA IN SOUTH AFRICA—*continued.*

	Cape Colony.	Cape Colony: Wm. Milne's List.	Orange River Colony.	Transvaal.	Natal.	Rhodesia.
Synchaeta oblonga Ehrbg.						×
Hydatina senta Ehrbg.	×	×		×		
Polyarthra platyptera Ehrbg.	×		×		×	×
Triarthra longiseta Ehrbg.			×		×	×
Notops brachionus var. *spinosus* Rousselet					×	×
Taphrocampa annulosa Ehrbg.		×			×	
Notommata aurita Ehrbg.		×			×	
„ *cyrtopus* Ehrbg.		×			×	
„ *naias* Ehrbg.					×	×
„ *saccigera* Ehrbg.					×	
„ *collaris* Ehrbg. (not Gosse)					×	
„ *tripus* Ehrbg.		×				
„ *brachyota* Ehrbg.		×				
„ *potamis* Gosse		×				
Copeus Ehrenbergi Ehrbg.		×			×	×
„ *cerberus* Gosse				×	×	
„ *triangulatus* Kirkman					×	
„ *pachyurus* Gosse					×	×
„ *caudatus* Collins		×				
„ *spicatus* Hudson		×			×	
Cyrtonia tuba Ehrbg.					×	
Proales descipiens Ehrbg.					×	
„ *petromyzon* Ehrbg.					×	
„ *daphnicola* Thompson						×
„ *sordida* Gosse		×				
Furcularia longiseta Ehrbg.		×			×	
„ *forficula* Ehrbg.		×				
Eosphora aurita Ehrbg.		×			×	
„ *naias* Ehrbg.					×	
„ *digitata* Ehrbg.					×	
„ *elongata* Ehrbg.					×	
Diglena forcipata Ehrbg.					×	×
„ *biraphis* Gosse					×	
„ *grandis* Ehrbg.					×	
„ *mustella* Milne		×				
„ *uncinata* Milne		×				
„ *silpha* Gosse		×				
„ *Hudsoni* Glascott		×				
PLOÏMA. LORICATA.						
Rattulus rattus Ehrbg.					×	
„ *bicristatus* Gosse					×	
„ *mucosus* Stokes					×	×
„ *carinatus* Lamarck		×				
„ *pusillus* Lauterborn						×
Diurella porcellus Gosse		×			×	
„ *tigris* Müller		×			×	
„ *Dixon-Nuttalli* Jennings		×				
„ *stylata* Eyferth						×

Distribution of Rotifera in South Africa—*continued.*

	Cape Colony.	Cape Colony: Wm. Milne's List.	Orange River Colony.	Transvaal.	Natal.	Rhodesia.
Diurella tenuior Gosse		×				
„ *sejunctipes* Gosse		×				
Dinocharis tetractis Ehrbg.		×			×	×
Polychaetus (*Dinocharis*) *Collinsi* Gosse		×			×	×
Scaridium longicaudum Ehrbg.		×			×	
„ *eudactylolum* Gosse					×	
Diaschiza lacinulata Ehrbg.		×				
„ *gibba* Ehrbg.		×			×	×
„ *eva* Gosse		×				
„ *exigua* Gosse						×
„ *gracilis* Ehrbg.		×				
„ *cæca* Gosse		×				
Stephanops muticus Ehrbg.		×				
„ *intermedius* Burn		×				
Salpina ventralis Ehrbg.					×	
„ *macracantha* Gosse		×				
„ *eustala* Gosse						×
Euchlanis triquetra Ehrbg.					×	×
„ *macrura* Ehrbg.					×	
„ *dilatata* Ehrbg.					×	
„ *oropha* Gosse	×		×	×		×
„ *propatula* Gosse					×	
Ploesoma lenticulare Herrick						×
Cathypna luna Ehrbg.	×	×	×		×	×
„ *rusticola* Gosse		×				×
„ *leontina* Turner						×
„ *ungulata* Gosse						×
Distyla flexilis Gosse						×
„ *Ludwigi* Eckstein		×				
„ *Hornemanni* Ehrbg.		×				
Monostyla lunaris Ehrbg.		×				×
„ *bulla* Gosse		×				×
„ *cornuta* Ehrbg.		×				
„ *arcuata* Bryce		×				
Colurus (*Monura*) *bartonia* Gosse						×
„ *caudatus* Ehrbg.		×				
Metopidia solidus Gosse		×			×	×
„ *acuminata* Ehrbg.		×			×	
„ *oxysternum* Gosse					×	×
„ *lepadella* Ehrbg.				×		
„ *rhomboides* Gosse				×		
Pterodina patina Ehrbg.	×	×				×
„ *intermedia* Anderson					×	
„ *reflexa* Gosse		×			×	
„ *trilobata* Shephard					×	
Pompholyx complanata Gosse						×
Brachionus Bakeri Ehrbg.	×				×	×
„ *militaris* Ehrbg.		×			×	×
„ *quadratus* Rousselet			×			
„ *angularis* Gosse	×		×		×	×

DISTRIBUTION OF ROTIFERA IN SOUTH AFRICA—*continued.*

	Cape Colony.	Cape Colony: Wm. Milne's List.	Orange River Colony.	Transvaal.	Natal.	Rhodesia.
Brachionus angularis var. *caudatus* Barrois and Daday						×
" *pala* Ehrbg.	×			×		
" " var. *dorcas* Gosse	×					×
" *urceolaris* Ehrbg.	×					
" *furculatus* Thorpe	×		×	×		
" " var. *inermis* Rousselet			×	×		
Noteus quadricornis Ehrbg.		×			×	
Anuraea aculeata var. *valga* Ehrbg.			×			×
" " var. *curvicornis* Ehrbg.					×	×
" *cochlearis* Gosse		×	×		×	×
" " *forma micracantha* Gosse-Lauterborn						×
" " " *hispida* Gosse-Lauterborn						×
" " " *robusta* Gosse-Lauterborn						×
" " var. *tecta* Gosse					×	×
" *hypelasma* Gosse	×					×
Tetramastix opoliensis Zacharias						×
Pedalium mirum Hudson						×

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NOTES.

Phagocytosis of Malarial Crescents.

BY J. M. BERNSTEIN, M.B. (Lond.)

PLATE XVI.

WHILST examining some fresh blood-films, taken from a man (a patient in the Westminster Hospital), who had contracted the malignant type of malarial fever some twelve months previously on the West African coast, we noticed, to us, an unusual method of destruction of the crescentic form of the parasite. The process was one of phagocytosis, with peculiar behaviour of the surrounding leucocytes.

Two films were made, and the cover-slips surrounded with vaselin to prevent evaporation, and, though not examined on a warm-stage, the heat of the oil lamp concentrated through the condenser appeared to act as such, for the leucocytes remained fairly active during the period of observation, about five hours.

The films were examined under a Zeiss objective $\frac{1}{8}$-in. ocular No. 3, and from each, at intervals of a few minutes, a series of sketches was made of the same field, which contained at the outset a leucocyte, some red blood-corpuscles, and a female crescent with well marked centrally arranged pigment granules. A selection of these diagrams is appended (Plate XVI.).

The process seems to divide itself into two parts, viz., the ingestion and destruction of the crescent, and the attempted destruction of its pigment.

At 1.45 p.m. the film was made, and a crescent brought into the field of view. At 2.30 p.m. it had altered in shape and become more spheroidal, and was partially within the substance of a leucocyte (fig. 1), which a few minutes later entirely surrounded it (fig. 2). Within the substance of the leucocyte a vacuole began to form around the crescent, whose outline could barely be distinguished from that of the vacuole at 2.50 p.m. (fig. 3). At this time the pigment granules became very active, and they danced about with great energy, giving the impression that the crescent was still alive, though shortly afterwards its outline could not be distinguished, and only the pigment remained. Around this the vacuole increased in size, and by 3.10 p.m. (fig. 5) occupied the greater portion of the leucocyte, with the now motionless pigment at its centre. It continued to grow for a few minutes more and

then burst, leaving the pigment in the centre of the leucocyte (fig. 6), at 3.14 p.m., and a new vacuole started to form around it again.

During all this time the leucocyte was constantly undergoing amœboid movements, and at 3.22 p.m. the vacuole with its pigment lay at one end (fig. 8), and it looked as though it would be disgorged. But it was not so, and, despite this amœboid activity, the pigment—surrounded by a vacuole which grew, burst, and re-formed repeatedly—remained within the leucocyte, sometimes at the centre, sometimes at the periphery.

For the first hour there was only one leucocyte in the field, but then a second corpuscle appeared at the edge and moved towards the centre, and by 3.30 p.m. (fig. 9) had approached and apposed itself to the first corpuscle. Around the circumference of this it proceded to travel (figs. 10–12), and at 3.49 p.m. it had wandered off again, and numerous red blood corpuscles separated the two (fig. 13). No further change could be observed during this apposition. This second leucocyte (x) remained in the field, at times approaching the first one, and some time later a third leucocyte appeared (y), which was followed by two more, making altogether five under observation at one time (figs. 14–19). At 4.33 p.m. leucocytes x and y had apposed themselves to the edge of the original phagocyte (fig. 20) and withdrew a short distance. Meanwhile another was approaching (fig. 21), and this formed with the first two reinforcements a group of three, which at 4.38 p.m. completely surrounded the pigment-containing leucocyte (fig. 22), which at this time contained several small vacuoles, each enclosing some pigment. At 4.40 p.m. they had all separated again (fig. 23) and one of the reinforcing corpuscles now contained a small particle of pigment surrounded by a vacuole, and with this it wandered off, making unsuccessful attempts to leave the pigment behind at the end of a pseudopodium (fig. 24). This reinforcing process was repeated several times, and at 5.16 p.m., and later, pigment was noticed in several of the leucocytes that had entered the arena entirely free from pigment—hence it could not have been derived from other crescents caught by themselves (fig. 26).

By this time the activity of the corpuscles was diminishing, but that they were still alive was shown by the apposition of two at 6.5 p.m. (fig. 27), no others being seen in the field, whilst at

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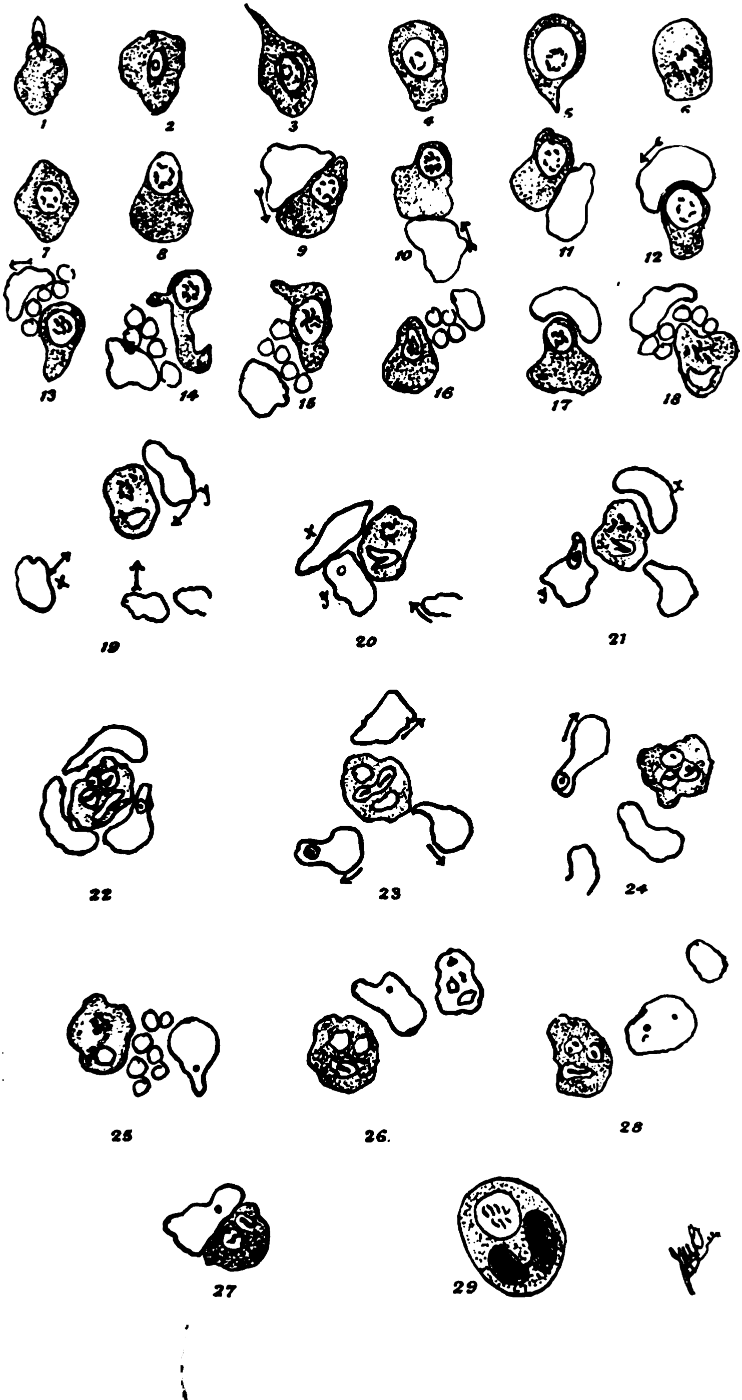
EXPLANATION OF PLATE XVI.

Only the first leucocyte is stippled, the others merely outlined. The nucleus has been purposely omitted in most of the figs. to simplify the description. In figs. 13–18 red corpuscles are shown, but drawn too small. In fig. 29 the bilobed deep staining nucleus is shown. The arrows indicate the direction in which the corpuscles were moving at the time of drawing.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6.40 p.m. (fig. 28) three leucocytes were seen apart, each containing pigment. The original phagocyte now contained several vacuoles and some pigment, and was very sluggish.

Some time later the cover-slip was separated from the slide and stained by Leishman's method, and examined under objective $\frac{1}{12}$ in. Several polymorphonuclear leucocytes were found (fig. 29), each containing pigment granules in a large vacuole, the cytoplasm also being vacuolated and staining feebly: changes no doubt due to the slow death of the leucocyte.

Evidently, then, these polymorphonuclear leucocytes were the phagocytes concerned, and the full process was (1) ingestion and destruction of a crescent, (2) attempted destruction of the remaining pigment, introducing (3) a union of several leucocytes, apparently to reinforce the first one, and (4) the removal of some of the pigment by these new comers.

Whether the crescent was still alive at the moment of ingestion is uncertain. It is also difficult to say how far the process depended on the conditions of observation, and as to whether it occurs *intra vitam* in the circulating blood.

Similar observations were made on a second film, with exactly similar results, by the late Mr. R. W. Newman (of the Westminster Hospital), whose untimely death from blood poisoning, contracted whilst assisting at a necropsy, was an inexpressible loss to his friends and his profession.

A Simple Wave-length Spectroscope.

Made to the designs of E. M. NELSON and J. W. GORDON by R. & J. BECK, Ltd.

THIS apparatus (fig. 53) has been designed for testing colour screens, but is suitable for many other purposes. It consists of a Thorp's diffraction grating A placed at the centre of a board, on one side of which is placed a slit B. Pivoted on the centre is an arm C, which carries at its end an eye-piece D, in the focus of which are cross wires. The arm C has an index, which reads direct on the scale E in millionths of an inch, the wave-length of the light against which the wires are set. F and G are two lenses, one for collimating the slit B, and the other for focusing to the eye-piece D.

The chief point of interest about the apparatus is the simple manner in which the scale of wave-lengths is obtained.

With a diffraction grating the formula which connects the angle of deviation of the light with the wave-length is as follows—

$$\text{Sin } \theta = \frac{\lambda}{\Delta} \quad . \quad . \quad . \quad . \quad (1)$$

where θ = the angle of deviation,
λ = wave-length,
Δ = the centre to centre distance of the lines of the diffraction grating.

Now if the lines on the scale E are ruled parallel to the central

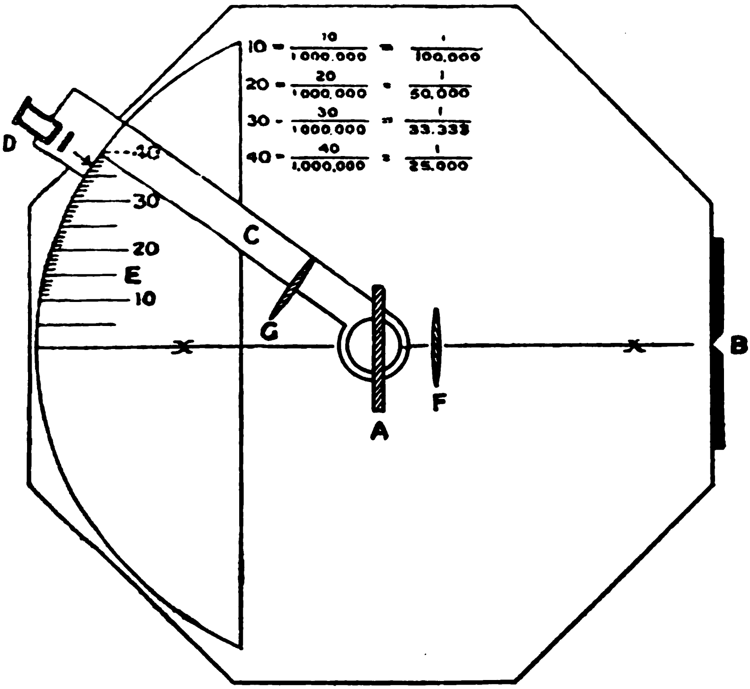

FIG. 53.

line X X, their distance from the central line X X divided by the radius of the circle on which the arm C swings is the sine of the angle of deviation, and is therefore proportionate to $\frac{\lambda}{\Delta}$ or

$$\text{Sin } \theta = \frac{s}{\text{R}} = \frac{\lambda}{\Delta} \quad . \quad . \quad . \quad (2)$$

when s = one of the divisions of scale E, and R = radius of circle.

Tenths of an inch have been selected as being a convenient

measurement to make the divisions of the scale E, and the necessary length of the radius of the circle on which the divisions must be read is given as follows.

It is assumed that 1 division of $\frac{1}{10}$ inch represents $\frac{1}{1000000}$ of an inch, therefore

$$\frac{s}{\lambda} = 10^5 \quad . \quad . \quad . \quad . \quad (3)$$

Therefore from (2) and (3)

$$R = \frac{s}{\lambda}\Delta = 10^5\Delta$$

This shows the radius of curvature that is required in making the instrument, and a series of parallel lines ruled on the scale parallel to the base line, $\frac{1}{10}$ of an inch apart, complete its graduation.

SUMMARY OF CURRENT RESEARCHES

RELATING TO

ZOOLOGY AND BOTANY

(PRINCIPALLY INVERTEBRATA AND CRYPTOGAMIA),

MICROSCOPY, ETC.*

ZOOLOGY.

VERTEBRATA.

a. Embryology.†

Effects of Alkalis and Acids on Developing Ova of Sea-Urchin.‡ B. Moore, H. E. Roaf, and E. Whitley point out that in nearly all cases of malignant disease the secretion of hydrochloric acid by the gastric glands is stopped or greatly reduced. This effect is not due to local conditions in the stomach: it occurs wherever the growth is situated. It is due to a change in the distribution of salts in the plasma whereby the alkalinity is increased or the concentration in hydrogen ions diminished. Addition of small amounts of alkalis or alkaline salts to the medium in which sea-urchin eggs are developing, causes at first an increase in rate of growth and division, but as the amount is increased, there is irregularity in the size and shape of the cells produced—nuclear division gets ahead of cytoplasmic division. With further increase, division stops. Accompanying the increased stimulus to nuclear division, there are many atypical forms of mitosis, as in malignant growths. The minutest amount of added acid has an inhibitory effect upon growth and nuclear division. The extreme limits at which life and cell-division are possible lie close together, indicating that the cell is extremely sensitive to even slight changes in the hydrogen and hydroxyl ion concentration.

Effect of Acids and Alkalis on the Eggs of Plaice and Sea-Urchin.§—E. Whitley has made experiments on the effect of acid, alkali, and certain indicators in arresting or otherwise influencing the develop-

* The Society are not intended to be denoted by the editorial "we," and they do not hold themselves responsible for the views of the authors of the papers noted, nor for any claim to novelty or otherwise made by them. The object of this part of the Journal is to present a summary of the papers *as actually published*, and to describe and illustrate Instruments, Apparatus, etc., which are either new or have not been previously described in this country.

† This section includes not only papers relating to Embryology properly so called, but also those dealing with Evolution, Development, Reproduction, and allied subjects.

‡ Proc. Roy. Soc., Series B, lxxvii., No. B 515 pp. 102–36 (30 figs.).

§ Tom. cit., pp. 137–49.

ment of the eggs of *Pleuronectes platessa* and *Echinus esculentus*. He finds that the amount of variation from the normal concentration of hydrogen and hydroxyl ions in sea-water which the eggs of the plaice will tolerate is very small. A disturbance of the equilibrium towards the acid side is much more fatal than the opposite. A progressive development of resistance to unfavourable action of the environment takes place in proportion to the age of the eggs. Phenolphthalein is deadly to the eggs of the sea-urchin, but harmless to those of the plaice, while dimethyl quickly kills the latter, and appears, if anything, to have a favourable influence upon the development of the former.

Artificial Parthenogenesis.*—Yves Delage points out that the mode of action of the various agents which induce artificial parthenogenesis is still uncertain. Diverse methods have similar results, and no one is effective in all cases. Even an osmotic pressure greater than that of the sea-water, which is usually very effective, is not indispensable, for Delage's experiment with starfish ova, subjected to the influence of carbon dioxide in diluted sea-water, "hypotonic" in relation to the normal sea-water, was successful. Much seems to depend on the variable condition of the eggs themselves, and on the temperature of the medium. Acidification is favourable to parthenogenesis in the ova of starfish, unfavourable in the case of the sea-urchin (*Strongylocentrotus*). The mixture which gave best results was thus composed: sea-water, 3 c.cm.; solution of pure NaCl, 45 c.cm.; distilled water, 72 c.cm.; sulphite of soda, 5 drops. Delage has reared plutei which lived for 2–6 weeks, and one of the starfish larvæ obtained by the carbon-dioxide treatment lived for over four months.

Maturation and Fertilisation in Porpoise.†—W. Rubaschkin notes that the guinea-pig has an ovulation soon after parturition, and may then be inseminated. If copulation does not occur the vagina closes till the next œstrus. The maturation is for the most part in the ovary. Two polar bodies are always formed. After the appearance of the second directive spindle, the ovum passes into the Fallopian tube, where, or in the lower part of the oviduct, fertilisation takes place. The process of fertilisation is described.

Oolemma of Mammalian Ovum.‡ — A. Fischer describes the oolemma of the mammalian ovum as a product of the epithelium which surrounds the ovum; its growth is from within outwards in peripheral layers; it is a spongy, homogeneous sheath formed of a feltwork of threads from the epithelial cells; and it is penetrated until the period of maturation by fine processes connecting the epithelium with the ooplasm and playing a nutritive rôle.

Individuality of Chromosomes.§ — R. Fick has subjected to a searching criticism the whole framework of conclusions in regard to

* Comptes Rendus, cxli. (1905) pp. 1201–4.
† Anat. Hefte xxix. (1905) pp. 503-57 (4 pls.). See also Zool. Zentralbl., xiii (1906) p. 215.
‡ Tom. cit., pp. 555–89 (1 pl.). See also Zool. Zentralbl., xiii. (1906) p. 214.
§ Arch. Anat. Physiol. (Anat. Abth.) 1905, pp. 179–225. See also Zool Zentralbl., xiii. (1906) pp. 206–7.

chromosomes and their individuality, and finds it lacking in scientific security. It seems to him that in every animal there is a peculiar manœuvring of the chromatin, adapted to the physico-chemical exigencies of the case. As regards inheritance, we only see the gross manœuvres of regiments, so to speak, and we cannot argue from that to the behaviour of individual combatants.

Formation of Yolk in Egg of Sparrow.*—Dubuisson finds that just before the formation of the vitellus begins, the central zone of protoplasm, originally homogeneous, becomes vacuolar. The periphery remains an annulus of granular protoplasm. The nucleus lies tangentially to this annulus, quite eccentrically. Yolk plates begin to be deposited peripherally, and continue to appear in centripetal order in concentric layers. Different types of yolk-plates are described, and account for the old distinction between "white yolk" and "yellow yolk." The yellow yolk is a more evolved condition of the white yolk. There is also a less important centrifugal formation of yolk.

New Theory of Sex-Production.†—E. B. Wilson discusses the theory recently developed by R. Hertwig,‡ which is antagonistic to the view that sex is already determined in the fertilised egg. Issakowitsch has shown that in *Simocephalus* sex production shows a definite relation to temperature changes. At 24° C. there is a continuous production of parthenogenetic females, with only an occasional male; a reduction to 16° C. quickly leads, and a reduction to 8° C. immediately leads to the appearance of males and to the production of winter eggs. Starvation brings about the same result. Von Malsen has shown that in *Dinophilus* an elevation of temperature from 10°–12° C. to 25° C. changes the ratio of male and female eggs from 1:3 to 1:1·75 or even 1:1. R. Hertwig, working with frogs, was inclined to think that higher temperatures favoured the production of females, and found that over-ripeness or under-ripeness of the eggs led in every case to a large excess of males. In one case of under-ripe eggs 40 larvæ successfully reared were all males.

Hertwig's general theory is that the ratio between the nuclear and the protoplasmic mass $\left(\frac{k}{p}\right)$ tends towards a normal value that is in the long run constant for the species, though it undergoes cyclical changes both in the individual cell and in successive generations of cells. In ordinary or "functional" growth the value of $\frac{k}{p}$ decreases, in the subsequent "divisional" growth it rises above the normal, in cell-division the normal ratio is approximately restored. In long continued vegetative or asexual reproduction there is a gradual permanent increase in the value of $\frac{k}{p}$, a nuclear hypertrophy, which is remedied by conjugation. In the male $\frac{k}{p}$ is assumed to have a higher value than in the female, and

* Comptes Rendus, cxli. (1905) pp. 776–7.
† Science, xxiii. (1906) pp. 189–91. ‡ Verh. Deutsch. Zool. Ges., 1905.

any influence that tends to increase this value, whether in the gametes, zygote, or developing embryo, favours or determines the production of the male condition. In over-ripe and under-ripe ova the ratio $\frac{k}{p}$ has a high value.

Wilson points out that the central assumption rests on a very small basis of fact, and he proceeds to show that even that small basis is unconvincing. He concludes that Hertwig's theory is without real foundation.

Sexual Differences of Chromosome Groups.*—E. B. Wilson brings forward evidence to show that "idiochromosomes" play a definite role in sex production in Hemiptera. In at least four genera, *Lygæus*, *Euschistus*, *Cœnus*, and *Podisus*, both sexes show the same number of chromosomes, but the small idiochromosome is present only in the male. Stevens, it is pointed out, has independently made a similar discovery in *Tenebrio*, so that the phenomenon is of wide occurrence in insects. The author concludes that the heterotropic or "accessory" chromosome has become unpaired in the male sex through the disappearance in that sex of its mate, and regards this as a complete explanation of the fact that in forms possessing the heterotropic chromosome the male number is odd, and one less than the female number. He believes that these facts may give the basis for a general theory of sex-production.

Formation of Hæmoglobin in the Embryo.†—L. Hugounenq and A. Morel have studied in this connection the developing egg of the fowl. Hæmatogen, probably belonging to the paranuclein group, has at first a number of functions in the egg. It contains, besides an albumen and a ferruginous pigment (subsequently differentiated as hæmoglobin), a reserve of sulphur, phosphorus, carbonate of lime, and magnesia.

Metamorphosis Independent of Nervous System.‡—P. Wintrebert finds that the larvæ of *Salamandra maculosa* proceed normally with their metamorphosis in spite of the destruction of a posterior portion of the spinal cord and spinal ganglia. In spite of the absence of medullary centres the tail of the larvæ of *Rana* and *Alytes* exhibits the normal phenomena of regression.

Sexual Selection.§—A. Forel alludes to recent criticism, e.g. by Groos ‖ and Lameere ¶, of Darwin's conclusion that female animals sometimes choose the more decorative males. He admits that there is some justice in the criticism, but thinks that it tends to go too far. A case in support of Darwin's position is given. A peahen that had never seen a peacock was brought into the presence of one outside the breeding season. She flew rather than ran to him in the greatest excitement, and circled round about him in obvious admiration. He remained quite cold and reserved until the advent of spring brought them together.

* Journ. Exper. Zool., iii. (1906) pp. 1–40 (6 figs.).
† Comptes Rendus, cxli. (1905) pp. 848–9.
‡ Tom. cit., pp. 1262–4.
§ Zool. Jahrb., xxiii. (1906) pp. 319–20.
‖ Hessische Blätter f. Volksunde, iii. heft 2, 3.
¶ L'Évolution des ornements sexuels, Bruxelles, 1904.

Forel thinks that there was no question of any direct sexual excitement; the peahen was simply filled with æsthetic transport at the novel sight of such a beautiful cock.

High and Low Dimorphism.*—G. Smith supplies data showing that the differentiation of the males of many species of Arthropods into high and low forms is of wide occurrence in distantly related groups which show a high degree of sexual differentiation. The high and low dimorphism may be facultative, as in those cases in which the low male by growth passes through an intermediate condition to the high male; or definitive, as in those cases where growth ceases on the assumption of the mature condition. The extent of development of the secondary sexual characters, i.e. their "highness" or "lowness," is strictly correlated with that of the primary sexual development. This latter is largely influenced by particular conditions of life, e.g. by nutrition and by the presence of particular parasites, and it appears that such influences have operated continuously in specific differentiation. As we are here dealing with the reproductive organisation, there is not the same *à priori* difficulty in the transmission of such affections as exists in cases where the body only is influenced.

Aortic Arches in Mammals.†—H. Lehmann finds that in both pig and rabbit embryos six aortic arches arise. In the pig there is a complete fifth arch on about the twenty-first day of development. There are also two entodermal pouches between the fourth and sixth arches. The rudimentary fifth in the rabbit, arising at about eleven-and-a-half days, is less complete. Remnants of the first and second transitory arches are persistent in the pig, so that parts of six aortic arches exist simultaneously. The subclavians begin from the dorsal aorta and shift forward in front of the union of the aortic roots. The pulmonary arteries arise as symmetrical vessels from each sixth arch, and in the pig become asymmetrical by union of the stems from both sides, reaching the condition figured by Rathke. This is, however, a secondary condition, their symmetrical origin having been pointed out by Bremer.

b. Histology.

Dual Force of the Dividing Cell.‡—M. Hartog records a series of experiments upon the forces of the dividing cell. His more important conclusions may be briefly indicated. The cytoplasmic figure of the dividing cell is a strain-figure, under the action of a dual force, analogous to magnetism, and still more to statical electricity; without prejudice as to its nature, it is termed "mitokinetic force," or "mitokinetism." By comparison with magnetic models, it is found that the spindle-fibres and astral rays, the Hautschicht of the cytoplasm, the nuclear wall, and the free chromosomes along the cell-spindle, must all be of high permeability to mitokinetism as compared with the other structures of the cell. Detailed comparisons with magnetic models are given. It is found

* Mitth. Zool. Stat., Neapel, xvii. (1905) pp. 312-40 (2 pls. and 13 figs.).
† Zool. Jahrb. Abt. Anat., xxii. (1905) pp. 387-434 (4 pls.).
‡ Proc. Roy. Soc., Series B, lxxvi. (1905) pp. 548-67 (3 figs.).

that a spindle figure can only be obtained in a field with the two unlike poles of a dual force. Diffusion, osmosis, and surface tension cannot be the forces involved in the spindle. Further, since an isolated magnetic pole cannot exist, it is obvious that the cell-fields, being in three dimensions, and with isolated unlike poles, cannot be due to magnetism. It is not impossible that the field may be produced by statical electricity, but of this at present there is no proof.

Studies on Chromosomes.*—E. B. Wilson finds that the chromosomes which have been called by Montgomery "heterochromosomes" in Hemiptera, include three distinct forms, provisionally termed (*a*) the paired microchromosomes, or *m*-chromosomes; (*b*) the idiochromosomes; (*c*) the "accessory," or heterotropic chromosomes. The structure, relations, and behaviour of these are discussed in the present two papers, and it is concluded that the facts support the general theory of the individuality of chromosomes, the theory of Montgomery in regard to synapsis, and that of Sutton and Boveri regarding its application to Mendelian inheritance; and they point towards a definite connection between the chromosome group and the determination of sex.

Histology of Mammalian Nostril.†—B. Kormann gives a comparative account of the histological structure of the nasal vestibule in various domestic mammals, and of the diverticulum nasi of the horse. The vestibulum nasi differs as to its extent in different mammals: it is covered by a many-layered flattened epithelium and with a papillary body, and contains glands reaching to the sub-mucosa. These are tubular glands of a serous character. The covering of the wall of the diverticulum nasi of the horse is not a mucous membrane. It is a direct continuation of the outer skin, from which, however, it is distinguished by the possession of only quite thin and weak hairs. It contains numerous sebaceous glands in the corium, and abundant sweat-glands in the sub-cutis. Between this integumental layer and the true nasal mucous membrane, which has ciliated epithelium, there is a small band of vestibular mucous membrane very rich in serous glands.

Skin of Reptiles.‡—F. Krauss has investigated the relations of epidermis and cutis in Lizards and Crocodiles. He describes the development of the cutis from the rete Malpighi, and notes in the skin of many adult reptiles—especially in the looser connective tissue of the scales—frequent suggestions of embryonic conditions. As such may be quoted gelatinous tissue between the cutis and epidermis. The relation between the epithelial fibres of the epidermis cells and the connective tissue fibres below the epithelium is also described.

Amphioxus Brain.§—L. Edinger describes various hitherto unknown features in the central nervous system of *Amphioxus*. The central canal of the spinal cord shows an anterior widening—the brain vesicle whose degree of development in mature animals appears to be

* Journ. Exper. Zool., ii. (1905) pp. 371–405 (7 figs.) and 507–45 (4 figs.).
† Anat. Anzeig., xxviii. (1906) pp. 5–16 (1 fig.).
‡ Arch. Mikr. Anat., lxvii. (1906) pp. 319–63 (2 pls. and 14 figs.).
§ Anat. Anzeig., xxviii. (1906) pp. 417–28 (15 figs.).

variable. This anterior cavity is broader and lower than the spinal canal. It is lined by epithelium which is continuous with that of the latter. An account is given of the olfactory nerve, the frontal organ, the pigment spot and its nerves, the ganglionic dorsal apparatus, and the dorsal giant cells of the frontal section—the oblongata of authors.

Growth and Renewal of Dermis.*—Ed. Retterer concludes that the phenomena of embryonic development and adult histogenesis are practically the same as regards the dermis. The germinal epithelium furnishes superficially the mucous or corneous elements, and, internally, the cells which are transformed into denser connective tissue (dermis) and reticular tissue (lymphoid). The epithelium is the initial tissue, forming epidermic elements which are desquamated off, and deeper elements which form, add to, and replace the constituents of the dermis.

Pathological Nature of Holmgren's Canaliculi in Nerve Cells.†—R. Legendre maintains that the "Saftkanälchen" which Holmgren described in 1900 in the snail—fine prolongations from interstitial cells entering the nerve cells—are well-known neuronophagous phenomena, due to a kind of phagocytosis on the part of the neuroglia cells.

Structure of Gas-Gland in Swim-Bladder.‡—Karolina Reis and J. Nusbaum give an account of the minute structure of the epithelial body or gas-gland of species of *Ophidium*, and of the disruptive process by which gas is evolved. They also discuss the "oval" which functions as an elastic pressure-regulator, evaginating and invaginating, and thereby affecting the gaseous content of the bladder.

Whitening of Hairs and Feathers in Winter.§—El. Metchnikoff adheres to his previous conclusion that "chromophagous" cells transport the pigment from hairs into the skin or to the surface. The theory that the blanching is due to gas cannot suffice, for the gas is only in the medullary portion of the hairs. He has made observations on *Lepus variabilis*, *Lagopus albus*, and *L. alpinus*, on a hen which began to turn white, and has found the chromophagous cells at work.

Shape of Human Erythrocytes.‖—H. E. Radasch finds that the majority of the erythrocytes in the circulating blood of fœtus and adult are bell-shaped. On exposure to air the bells collapse and become disks.

c. General.¶

Origin of the Deep-Sea Fauna.¶—A. E. Ortmann argues that the present deep-sea fauna—adapted to very low temperature—must have had an origin subsequent to the polar cooling, which probably occurred in Tertiary ages. Part of the fauna may be autochthonous, adapted from previously existing Mesozoic or pre-Tertiary forms which had

* Journ. de l'Anat. Physiol. xlii. (1906) pp. 297–304.
† Comptes Rendus, cxli. (1905) pp. 1265–7.
‡ Anat. Anzeig., xxviii. (1906) pp. 177–91 (2 pls.).
§ Comptes Rendus, cxlii. (1906) pp. 1024–8.
‖ Anat. Anzeig., xxviii. (1906) pp. 600–4.
¶ Eighth Internat. Geograph. Congress, 1905, pp. 618–20. See also Zool. Zentralbl., xiii. (1906) pp. 302–3.

peopled the deep sea before it acquired a low temperature. Another part may be referred to a Tertiary migration from littoral regions at both poles: the northern contingent derived from an ancient Mesozoic Mediterranean fauna, the southern contingent derived from an ancient Pacific fauna. Another, but less probable, mode of origin would be a direct migration from tropical littoral faunas.

Slime-Formation in the Sea.* — C. Cori describes the occurrence of immense quantities of slime in the Gulf of Trieste in the summer of 1905. It was so marked that it lessened the number of pelagic organisms, smothered many littoral forms, and fouled the nets of the fishermen. It was mainly due to encysting Peridineæ, and secondarily to Bacillariaceæ.

Anhydrobiosis, Parthenogenesis, and Phototropism.† — G. Bohn calls attention to the fact that Giard has induced artificial parthenogenesis in the eggs of starfish by physical and chemical dehydration, and subsequent exposure to the exciting action of the sea-water. So, Bohn points out, there is physical and chemical dehydration in supralittoral animals, like *Littorina rudis* and *Harpacticus fulvus*, when the tide is out, and an extraordinary excitation when the tide comes in again. There is very marked negative phototropism; there are extremely active movements which have an optic origin. There is an established vital periodicity determined by the tides, for even in an aquarium, although the desiccation or intoxication persists, the creatures awake from their torpor, and with mathematical precision make for the shaded regions. We do not follow the argument, but the author says there is a complete parallelism between artificial parthenogenesis and phototropism.

Fauna of Natal.‡—Ernest Warren presents the first report of the Natal Government Museum, which shows in the text and by the illustrations what arrangements have been made to preserve and exhibit for museum purposes the fauna and flora of Natal. The report, which says much for the industry and thoughtfulness of the director, includes catalogues of ethnological exhibits, and of the mammals, birds, reptiles, amphibians, fishes, invertebrates, fossils, etc.

Peripheral Nervous System of Mammals.§—E. S. London and D. J. Pesker have investigated various embryos of white mice as regards the nerve endings in striped and smooth muscle, and especially in heart muscle. They describe the finer structure of the ganglion cells of the heart, and the sensory cells of the inner ear. In the tympanal wall of the cochlear canal the outer and inner hair cells develop as cells pointed at the lower end. Gradually from the ganglion cells there grow out spiral fibrils which are directed to the lengthening point of the

* Archiv Hydrobiol. Planktonkunde, i. (1906) pp. 385–91. See also Zool. Zentralbl., xiii. (1906) pp. 300–1.

† Comptes Rendus, cxli. (1905) pp. 1260–2.

‡ First Report of the Natal Government Museum, year ending December 1904, (Pietermaritzburg, 1906) 185 pp., 14 pls.

§ Arch. Mikr. Anat., lxvii. (1906) pp. 303–18 (3 pls.).

forenamed cells and which presumably unite with them. In the process of development there is an evident stimulus towards the formation of a fibrillar net from the granular content of the protoplasm of the sense-cell.

Eye of Spalax typhlus.*—J. Szakáll describes the degenerate eye of this "blind mouse." There is no eyelid opening; the eye lies in a closed conjunctival sac; and the light can only enter through the skin. All the essential parts are present, but they remain undifferentiated. Thus the anterior and posterior basal membranes are lacking in the cornea; the choroid is not separated from the sclerotic; the ciliary bodies are wholly due to folds of the pigment layer of the retina; the retina is relatively undifferentiated; the lens is a mass of irregular cells, undergoing disruption; the anterior wall of the lens is directly apposed to the posterior surface of the cornea; the arteria hyaloidea, as an embryonic vestige, is always demonstrable; the eye-muscles are quite absent, but the Harderian gland is unusually large.

Relationships of the Tarpan.†—J. Cossar Ewart concludes that the Tarpan, once common in the east of Europe, cannot be regarded as a true wild species. It may be assumed that the Tarpan herds were derived from at least three primitive stocks, viz. (1) from a variety or species identical with or closely related to the wild horse (*Equus prejvalskii*) still surviving in Central Asia; (2) from a variety having the characteristics of the Celtic pony (*E. c. celticus*); and (3) from a variety resembling the forest horse (*E. c. typicus*). The variety of characters seen in the Tarpans suggests this multiplex origin. Experiments in progress may settle what part Prejvalsky's horse had in forming the Tarpan. The author adheres to his general view that domesticated horses have had a multiple origin, and include plain as well as striped forms amongst their less remote ancestors—have not, in fact, as Darwin thought, descended from a single dun-coloured, more or less striped, primitive stock.

Arrangement of Bronchial Blood Vessels.‡—W. S. Miller gives an account of the arrangement of the vessels in the bronchi and their relation to the pulmonary vessels. They are directly connected with the pulmonary vein, and can be only partially injected from the pulmonary artery when the pulmonary vein is clamped, and then by a backward flow along the venous radicles which arise from the bronchi.

Cranial Nerves in Chick.§—F. W. Carpenter gives an account of the anatomy, histology, and development of the oculomotor nerve, the ciliary ganglion, and the abducent nerve in the chick. There is also a discussion of the migration of the medullary cells, the histogenesis of the neuraxons, the nature of the ciliary ganglion, and the homologies of the oculomotor and abducent nerves.

* Math. Nat. Ber. Ungarn., xx. (1905) pp. 272–88 (5 figs.).
† Proc. Roy. Soc. Edinburgh, xxvi. (1906) pp. 7–21 (3 pls. and 2 figs.).
‡ Anat. Anzeig., xxviii. (1906) pp. 432–6 (3 figs.)
§ Bull. Mus. Comp. Zool. Harvard, xlviii. (1906) pp. 141–229 (7 pls.).

Notes on Sea Snakes.*—T. V. R. Aiyar communicates some interesting notes on some sea-snakes caught at Madras. They occur all the year round, but are more abundant during the cold weather (October to February). Big snakes generally approach the shore at night. The small head and attenuated neck are specially adapted to penetrate into crannies among the rocks. In the young there are often bright bands and streaks which grow dull afterwards. Almost all the forms are fish-eaters, but crustaceans were also found in the gut. The ecdysis takes place in piece-meal fashion, and the interesting fact is noted that some specimens kept in fresh-water underwent the process of moulting more or less like the land snakes. Not a few bore barnacles and epizoic hydroids. Once out of their native element, the sea-snakes generally become quite helpless and appear blind, except *Distera viperina*.

Cranial Nerves of Varanus Bivittatus.†—Grace B. Watkinson supplies a marked deficiency in our knowledge by giving an anatomical account of the cranial nerves in this lizard. The whole subject has been much neglected as far as Reptiles are concerned.

Reptiles and Amphibians of Russia.‡—A. Nickolsky has published a detailed account (in Russian) of the Reptiles and Amphibians of the country.

Tadpoles Caught by Bladderwort.§—W. Bath describes the capture and imprisonment of small tadpoles by the bladders of *Utricularia vulgaris*. Sometimes the head is caught at the "door," sometimes the tail, sometimes the tadpole gets quite inside. The imprisoned animals may live for some days inside the bladder.

Meristic Variations in Toad.‖—Seitaro Goto describes some interesting variations in the vertebral column of *Bufo vulgaris*, e.g. bifid transverse processes of third vertebra; fusion of seventh and eighth; sacrum formed by ninth vertebra on the right side, and by the ninth and tenth on the left; sacrum formed entirely by the tenth, the ninth being small and fused to the tenth. He also reports the occurrence of two spleens with separate arteries.

Fossil Flying Fishes.¶—O. Abel describes under this title the "ganoids," with large pectoral fins, occurring in the Trias of Austria, Germany and Italy, e.g. *Thoracopterus mederristi* and *Gigantopterus telleri* g. et sp. n., and *Dollopterus* (*Dolichopterus*) *volitans*. There is a marked convergence in shape and in pectoral fins to the modern *Exocœtus*. A consideration of the so-called "flying fishes" of the chalk (*Chirothrix*) leads the author to believe that they were inhabitants of deep water, and did not use their fins for skimming through the air. The whole question of the adaptation of fins for "flight" is discussed.

* Journ. and Proc. Asiatic Soc. Bengal, ii. (1906) pp. 69–72.
† Morph. Jahrb., xxxv. (1906) pp. 450–72 (3 pls.).
‡ Mem. Acad. Imp. Sci. St. Petersbourg, xvii. (1905) pp. 1–517 (2 pls.).
§ SB. Ges. Nat. Freunde Berlin, 1905, pp. 153–5 (2 figs.).
‖ Annot. Zool. Japon, v. (1906) pp. 267–81 (8 figs.).
¶ Jahrb. k.k. geol. Reichanst., lvi. (1906) pp. 1–88 (3 pls., 13 figs.). See also Geol. Mag., Decade V., iii. No. 6 (1906) pp. 271–2.

Respiration in Bony Fishes.*—Taco Kniper has experimented with *Barbus fluviatilis*, *Telestes muticellus*, and *Cyprinus auratus*. Inspiration involves the opening of the mouth, the lowering of the floor of the mouth, and a moderate dilatation of the operculum. In this phase the gill-clefts are closed, and the water enters only by the mouth.

Expiration involves closing the mouth, raising the floor of the mouth, a posterior dilatation of the operculum and the associated membrane. In this phase the gill-clefts are open, and the water passes out only by them.

At the end of expiration there is a rapid approximation of the operculum to the body, ending the respiratory series of movements. The mouth begins to open again, and a new inspiration sets in.

German Carp in United States.†—L. J. Cole discusses this subject from the economic standpoint. In a very full paper he gives much interesting information regarding the habits of *Cyprinus carpio*, such as migrations, hibernation, vitality, feeding, and breeding; its diseases, parasites, and enemies; its economic relations and food value, etc. Its presence in the United States does not appear to be greatly appreciated, although it is recognised that, like the English sparrow, it has come to stay and cannot be exterminated. Suggestions are made as to how to use it to the best advantage.

Saw of the Sawfishes.‡—P. Pappenheim discusses the significance of the saw in *Pristiophorus* and *Pristis*. The few observers who have seen the animals living have not reported the real use of the saw. In the stomach of *Pristiophorus*, Pappenheim found vertebræ, jaw-fragments, etc., of fish; in *Pristis* he found cycloid scales, vertebræ, remains of crustaceans, etc. The articulation of the skull with the vertebral column is peculiar in *Pristiophorus*, and allows a vertical movement of the skull, as well as a rotation on its long axis. It seems likely that the saw is used primarily for rapid grubbing and burrowing in the mud and gravel. There may also be an accessory protective function, but there is no evidence of the saw being used as a weapon for ramming.

Abnormal Dogfish.§—G. P. Mudge describes a strange abnormality in *Scyllium canicula*. The stomach was turned inside out and everted into the pharyngeal cavity. That the condition was a permanent one is shown by the great length of the lieno-gastric artery and by other conditions. At quite an early stage in the differentiation of the primitive gut, the proximal loop of the stomach probably became gradually everted, this eversion setting up on one side a tension upon the lieno-gastric artery which grew with the growth of the everted sac, and, on the other side, a tension upon the proximal loop of the stomach near its junction with the distal loop, which resulted in the formation of a peculiar triangular invaginated cæcal pouch.

* Atti Rend. R. Accad. Lincei Roma, xv. (1906) pp. 385–94 (9 figs.).
† Dept. of Commerce and Labor, Bureau of Fisheries: Appendix to Report of Commissioners of Fisheries, Washington, 1905, pp. 523–641 (3 pls.).
‡ SB. Ges. Nat. Freunde Berlin, 1905, pp. 97–102.
§ Zool. Anzeig., xxx. (1906) pp. 278–80 (1 fig.).

Accessory Fins in Raia batis.*—J. Rennie records two cases of *Raia batis* in which in the mid-dorsal line there occurred accessory fins of somewhat complex structure. Although median in position, they appear to be of the nature of paired fins. In one a combination of fin structures occurred which is representative of different phylogenetic stages in the evolution of the Elasmobranch fin.

Chorda Tympani in Microtus.†—V. E. Emmel has made out the following in the development of the chorda tympani in *Microtus*. In the earlier stages it passes behind and underneath the spiracular cleft. In later stages it occupies a position over and in front of the closed end of the spiracular cleft. It is, therefore, a post-spiracular nerve, and is to be considered as the homologue of a post-trematic nerve of fishes and amphibians.

Jaw and Branchial Muscles in Elasmobranchs.‡—G. E. Marion describes the mandibular and pharyngeal muscles of *Acanthias* and *Raia*. In the latter, as might be expected from its shape, a few muscles are developed which are not found in the dogfish. These are the levator and depressor of the rostrum, and the cerato-hyomandibularis, which from its position seems adapted to the protrusion of the jaws. Apart from these the two forms studied agree very closely. The deeper ventral longitudinal muscles of *Raia* are described for the first time.

Membranous Labyrinth in Sharks.§—Charles Stewart describes this organ in five genera not dealt with by Retzius in his monograph. There is a considerable resemblance in the labyrinths of *Notidanus* and *Læmargus*. In *Lamna cornubica* there is fusion of portions of the two divisions of the utricle, forming a structure which has a close superficial resemblance to the sinus superioris utriculi of Teleosts; the cavities, however, remain distinct. *Alopecias vulpes* shows a similar characteristic; here the resemblance to the Teleostean sinus is even more marked.

Structure and Relations of Mylostoma.‖—C. R. Eastman points out the intimate structural resemblance between *Mylostoma* and *Dinichthys*, and, taking these forms as typical examples of Arthrodires, compares their general organisation with that of *Neoceratodus* and other Dipnoan fishes. Evidence is given for associating Arthrodires with Dipneusti, and their relations to fossil and recent members of the subclass are considered. A summary is also given of the leading facts in the evolutionary history of Dipnoans since their first appearance in the Lower Devonian until their decadence, bordering upon extinction, in the modern fauna.

Acromerite of Amphioxus.¶—B. Hatschek finds that the "rostral episomite process" in *Amphioxus* contains an elongated cavity, extending laterally to the notochord, and representing a direct continuation of the

* Anat. Anzeig., xxviii. (1906) pp. 428–31 (2 figs.).
† Journ. Comp. Neurol. u. Psychol., xiv. (1904) pp. 411–17.
‡ Tufts College Studies, ii. (1905) No. 1 (Scientific series) pp. 1–34.
§ Journ. Linn. Soc. (Zool.) xxix. (1906) pp. 407–9 (1 pl.).
‖ Bull. Mus. Comp. Zool., l. (1906) pp. 1–29 (5 pls.).
¶ Morphol. Jahrb., xxxv. (1906) pp. 1–14 (1 pl.).

first myocœl. The "rostral episomite process" contains no special "myomerite." The so-called first myomerite, which in young larvæ extends without limitation in a long rostral myomerite process, does not go so far forward in the fully formed animal, but ends about the cerebral vesicle. From its anterior margin a long triangular anteriorly pointed tendon is given off, which is attached to the median wall of the episomite process.

The first sclerocœl extends only as far forward as the muscle; it is not only dorsally but also ventrally closed off from the myocœl, being only connected with it ventrally at the posterior end of the segment. At the anterior margin of other typical myomerites there are tendon-fibres which penetrate into the myoseptum in front.

The last episomite gives off posteriorly on each side a hollow "terminal episomite process," extending laterally along the notochord. In its median wall there is a delicate terminal tendon continued from the last myomerite. The last myocœl is imperfectly separated from the penultimate myocœl.

Tunicata.

New Genus of Synascidian.*—Asajiro Oka describes *Aphambranchion*, a new genus of Synascidian from the coasts of Japan. It is, perhaps, to be regarded as within the family Distomidæ, if the diagnosis of the family is somewhat enlarged. The most striking peculiarity is that the branchial sac is very degenerate and almost indistinct. The thorax is so relatively minute that it appears simply as an inconspicuous appendage at the anterior end of the well-developed abdomen. Extremely small point-like apertures arranged in transverse rows represent the branchial clefts, and there is no dorsal lamina. This interesting new type is named *Aphambranchion japonicum*.

Development of Diplosoma spongiforme.†—A. Pizon has studied the complex phenomena of budding in this Diplosomid, which differ in their sequence from those in *D. listeri*. Particular attention is directed to the singular process of visceral bipartition, which the author calls "displanchtomy."

INVERTEBRATA.

Mollusca.

α. Cephalopoda.

Eyes of Cephalopods.‡—C. Hess finds a very sensitive optic purple in the retina of many genera, e.g. *Loligo*. It very closely resembles the similar pigment in Vertebrates. In all cases the colour of the fresh retina is brown to brownish-red; the colour of the preserved retina differs according to the illumination of the eye in the last hours of life. Three stages in the differentiation of the Cephalopod retina are distinguished :—(*a*) with uniform thickness and uniformly close rods (*Loligo*,

* Annot. Zool. Japon, v. (1906) pp. 253–65 (1 pl.).
† Comptes Rendus, cxlii. (1906) pp. 463–5 (1 fig.).
‡ Arch. ges. Physiol., cix. (1905) pp. 393–439 (4 pls.). See also Zool. Zentralbl., xiii. (1906) pp. 192–3.

Todaropsis, *Illex*); (*b*) in most cases with an area of most distinct vision, in which the rods are thicker and usually longer; (*c*) in Chun's deep-sea forms with a fovea-like area of most distinct vision, in which the rods are very long and narrow.

β. Gastropoda.

Eyes of Pulmonate Gastropods.*—G. Smith has made a study of the morphology and histology of the eyes in several Gastropods. His leading conclusions are as follows. The pigment cells of the retina of *Helix* and *Limax* are indifferent, the pigment-free cells are sensory. Each sensory cell gives off proximally one neurite to the optic nerve, and probably one or more branched processes which attach the cell to the capsule. The fibrillæ of the rods are normal structures of the living cell, and are doubly refractive to light. The neurofibrillæ form a network within the cell, uniformly distributed or massed into main paths through it. Appearances of pigment migration in the pigment cell of the retina of *Planorbis trivovis* were observed.

Achatinellid Fauna of Molokai.†—Fr. Borcherding begins a systematic account of the Achatinellids from this Sandwich Island—an interesting study of numerous species and varieties in a relatively small area.

Structure of Acmæa testudinalis.‡—M. A. Willcox publishes the first part of an anatomical account of this limpet, in which he deals at length with the superficial features, such as the blood-vessels seen without dissection.

British Nudibranchs.§—C. Eliot communicates notes on twenty-nine British Nudibranchs, including *Coryphella beaumonti* sp. n. and *Janolus flagellatus* sp. n. (?). The specimen recorded in the list of British forms as *Berghia cærulescens* must be removed from the list, as the specimen is *Facelina coronata*, but *Staurodoris verrucosa* may be added. A number of other points are cleared up in the paper.

Mutation in Molluscs.‖—F. C. Baker points out that in certain Molluscs, e.g. *Lymnæa*, "the species seem to be unstable, that is, they have a tendency to vary, not in a given direction, but in many directions at the same time. These seem to come under the head of Mutants or sports." "Where the mutation theory seems to fit in very nicely in explaining the very large amount of variation in the fresh-water pulmonates, we must not be too hasty in applying this new theory, founded as it is upon plant variation, to animal life."

δ. Lamellibranchiata.

Natural History of Margaritifera panasesæ.¶—A. W. Allen gives some notes on this small oyster, which occurs in New Guinea waters.

* Bull. Mus. Comp. Zool. Harvard, xlviii. (1906) pp. 233–84 (4 pls.).
† Zoologica, xix. (1906) heft 48, pp. 1–104 (5 pls. and 1 map).
‡ Amer. Nat., xl. (1906) pp. 171–87 (4 figs.).
§ Journ. Marine Biol. Ass., vii. (1906) pp. 333–82 (2 pls.).
‖ Amer. Nat., xl. (1906) pp. 327–34 (4 figs.).
¶ Journ. Linn. Soc. (Zool.) xxix. (1906) pp. 410–13.

Its early existence appears to be precarious. Deposits of young shells of fifty to the square foot, after five or six months were found almost completely devoured. A peculiarly insidious enemy is a small whelk, which pierces a neat hole in the thin shell, generally in the neighbourhood of the attachment of the adductor muscle. The result is loss of power to close the shell against the enemy, and every returning tide washes up numbers of young shells perforated in this way. The oyster does not appear to be altogether passive as regards its enemies, for where the situation is an exposed one the young form makes a tour in search of a cranny where it can hide. They often, however, only survive a few months, the secluded spots selected proving too small for their growing shells. For the purposes of locomotion a modified foot, like a muscular thread, is protruded from the byssal cleft. It gropes and tests the ground in every direction, eventually fixing itself and drawing the oyster after it. The latter then rests on its flatter, right side. Power of independent movement is confined to shells of six months age or under. The foot atrophies during the latter part of the bivalve's existence. On the other hand, the formation of new byssi is possible, and, if occasion demands it, occurs in shells of almost any age. The author makes an interesting comparison between the present species, *M. margaritifera*, and *M. maxima*. These three show grades of modification in hinge-teeth characters (rudimentary or absent), in nature of byssus, and in presence or absence of a modified foot.

Arthropoda.

a. Insecta.

Polyembryony and Sex-Determination.*—E. Bugnion calls attention to the fact that in *Encyrtus fuscicollis* all the individuals hatched from one parasitised caterpillar are usually of the same sex. P. Marchal observed the same in the individuals of *Polygnotus minutus* which issue from one parasitised Cecidomyid larva. The fact is a natural consequence of the polyembryony. As in the case of identical twins, the sexes of the products of one ovum are the same. When one parasitised caterpillar includes two or three ova of *Encyrtus*, and therefore several chains of embryos, both males and females may be hatched out. The partial abortion of one chain may result in unequal numbers of both sexes. As Bugnion points out, the facts seem to show that in this case the sex is pre-determined *in ovo*.

Assimilation of Carbon Dioxide by Chrysalids.†—Maria von Linden has experimented with chrysalids of *Papilio podalirius*, *Sphinx euphorbiæ* and *Lasiocampa pini*, and with caterpillars of *Botys urticata* and *Vanessa urticæ*, and has been led to conclude that when the atmosphere surrounding them contained 5–30 p.c. of carbon dioxide, there was often an absorption of that gas, accompanied (in spring) by an exhalation of oxygen. This process of assimilation occurs oftener during the day than at night, but respiration is more intense during the

* Arch. Sci. Phys. Nat., xx. (1905) pp. 699–702.
† Comptes Rendus, cxli. (1905) pp. 1258–60.

night. The investigator believes that the chrysalids can utilise carbon dioxide as green plants do, but one may be pardoned for desiring confirmation before accepting this momentous conclusion.

Mechanism of Compound Eye.*—E. J. Spitta suggests that the multiple images produced by the insect's eye are due to pin-hole effects. "It would seem that if the facets of the cornea were considered as nothing but little holes—filled, it may be, with some non-refractive material—all the difficulties about the focusing arrangement are at once swept away; for it is well known that every image is to a more or less degree in focus with a pin-hole. This would seem to imply that a very perfectly defined image is afforded by the insect's compound eye." The reason for the variation of the diameters of the facets is to enable the insect to possess a differential selection of optical arrangements. A criticism is made of Exner's experiment of photographing through an insect's eye from which retina and pigment were removed, and the eye-cavity filled with glycerin and water—thus making a lens. "It may be said that the photograph was obtained in spite of the cornea being present."

Palæozoic Insects.†—Anton Handlirsch has made a study of the North American Carboniferous and Permian insects in the U.S. National Museum, and gives a revision of all previously described species, 345 (137 re-named or new) in 169 genera (109 new). There is a striking agreement with European forms. Only one order (Blattoidea) extends into the Mesozoic; all the other orders are replaced in the younger formations by more specialised types. The Palæodictyoptera, which Handlirsch considers the stem group of all winged insects, appear first and decrease from the oldest beds to the younger, while the connecting links or transitional groups between the Palæodictyoptera and modern insect groups appear later than their conjectural ancestors, attain their maximum in the middle beds, and with the close of the Palæozoic again vanish.

Influence of Temperature on Lepidoptera.‡—H. Federley has made many experiments on the influence of changed temperature on the markings and coloration of Heterocera. Thus, low temperature favours black pigments, e.g. in *Saturnia pavonia*; warmth changes the grey markings of *Lymantria dispar* ♂ into brown, and so on. The scales are very modifiable in shape, size, and number. Of this many illustrations are given. According to the author, the thermal influence operates in part by altering the pressure of the hæmolymph; in part, perhaps, by directly affecting the metabolism in the plasma of the scale mother-cells.

Effect of Temperature on Insect Development.§—F. Merrifield discusses this subject, illustrating his conclusions by reference to various experiments. There appear to be various degrees of response to changes in temperature; some species react with great regularity, on others

* Journ. Quekett Micr. Club., 1906, pp. 263–8.
† Proc. U.S. Nat. Museum, xxix. (1906) pp. 661–820.
‡ Festschrift für Palmen, No. 16 (Helsinfors, 1905) pp. 1–118 (3 pls. and 7 figs.). See also Zool. Zentralbl., xiii. (1906) pp. 329–31.
§ Trans. Entomol. Soc., 1905, pt. 5, pp. lxxxiii.–cxi.

warmth appears to be expended in vain. Cold appears to be necessary to mature winter pupæ, e.g. *Thais polyxena* and *Rumia luteolata* kept at 27° C. for part of the winter nearly all died. In contrast to winter pupæ killed by the absence of cold are quoted summer pupæ of *Selenia tetralunaria* and of *Araschnia levana*, which were kept, retarded, and changed in facies, but uninjured by a low temperature, for more than four months, and those of *Zonosoma punctaria* for more than six months. Other points considered in this interesting paper are the question of the transformation of single- and double-brooded types, and the alteration of colour and pattern by temperature.

Maturation of Unfertilised Eggs in Tenthredinidæ.*—L. Doncaster describes the maturation process and early development of parthenogenetic eggs in saw-flies. There appear to be several fundamental differences from the process in bees. In the saw-flies the conjugation of the polar nuclei takes place only in the male-producing species, and the group of chromosomes which results ultimately disintegrates; but the fact that it commonly divides into two groups lying side by side may be compared with the production of "double nuclei" in the bee. The number of chromosomes in all the divisions is constant, and no trace was seen of tetrads or dyads to indicate the occurrence of reduction. The somatic number of chromosomes is the same (at least up to the formation of the blastoderm) as the number in the polar mitoses.

Variations of Lycæna astrarche in Britain.†—L. W. H. Harrison finds that *Lycæna astrarche* Brgstr. and the variety *artaxerxes* are connected by transition forms. The typical form in the south of England entirely resembles the Continental form, and has two generations annually. In the north of England, especially in Durham, there are distinct varieties, and one brood in the year. They approach the variety *artaxerxes*, and have a longer larval period. The typical form is to be found on the stork's bill, the Durham variety on the rock-rose. The variety *salmacis* predominates in Durham, and the adults show sexual dimorphism, which is absent in *artaxerxes*, the predominating variety in Scotland. Harrison's general conclusion is that *L. astrarche* and *artaxerxes* are geographical varieties.

Mendel's Laws applied to Silk-worm Crosses.‡ — Kametaro Toyama finds that some of the characters of silk-worms, e.g. colours of cocoons and larval markings, strictly follow Mendel's laws, while others do not. As the result of crossing the disintegration of parent characters takes place. Each character thus produced behaves exactly like an independent character, breeding true to parents. Conversely, the combination of two characters takes place, and the forms produced remain constant when bred together. Bateson's theory of allelomorphs is confirmed. The behaviour of a character when crossed, however, depends in some degree upon the characters of its ancestors, since in one case (Siamese "whites" × Siamese "yellows") no disintegration of the

* Quart. Journ. Micr. Sci., No. 196 (1906) pp. 561-89 (2 pls.).

† Bull. Soc. Lépidopt. Genève, No. 1 (1905) pp. 30-2. See also Zool. Zentralbl., xiii. (1906) p. 331-2.

‡ Biol. Centralbl., xxvi. (1906) pp. 321-34.

parent characters takes place, while in other cases (Japanese "whites" × Siamese "yellows" or "Japanese "whites" × European "yellows") it may often be observed. Sometimes it happens that both dominant and recessive characters, even sexual ones, appear as active characters in an individual body.

Coleoptera and Moths of United States.*—C. Schaeffer gives some notes on new genera and species of Coleoptera found within the United States. Short descriptions of the Mexican species are given. There is also recorded a list of Bombycine moths from the Huachuca Mountains, Arizona. H. G. Dyar describes several new species of moths, also from Arizona.

Bionomics of South African Lamellicorns.†—G. B. Longstaff gives some interesting notes on certain species of Cetoniinæ and Hopliinæ. These beetles apparently play a large part in the fertilisation of flowers, and amongst the examples referred to are some protectively coloured like the plants they visit, cases of mimicry, e.g., *Gametis balteata* resembles certain Lycoid beetles which are very distasteful to Kestrels and Baboons. An interesting case is that of *Heterochelus* ♂, which has greatly elongate and denticulate hind legs. These project above the florets when the beetle is busy burrowing into the disks of Compositæ with its body almost completely buried. They resemble the widely separated jaws of an ant-lion, and on being touched can give a very respectable pinch, inflicted by the formidable teeth upon the inner margins. These legs were probably in the first instance adapted to assist the male insect in grasping its mate.

Abdomen of Female Chafer.‡—B. Wandolleck gives a comparative account of the morphology of the abdomen of the female in sixteen species of Cerambicidæ. Although there appear to be three types, these are connected by intermediate forms, so that a fundamental similarity exists in all.

Stegomyia fasciata and Yellow Fever.§—E. Marchoux and P. L. Simond find that there is a possible hereditary transmission of the amaril virus in *Stegomyia fasciata*. An infected mosquito may produce eggs which give rise to infected individuals. But this does not play an important role in the propagation of yellow fever. The mosquito is not infected either by blood from hæmorrhage, or by vomit, or by fæces; larvæ reared in water with dead bodies of infected mosquitos are not infected. The virus may be artificially passed from mosquito to mosquito, but this does not occur in nature. The adult insects kept in contact with the dead bodies of infected forms are not infected. Unlike many other Culicidæ, the female *Stegomyia fasciata* does not die after its first oviposition.

New Sense-Organ on Head of Corethra Larvæ.‖—Em. Radl describes a peculiar sensory organ on the head of this larva. It has

* Museum Brooklyn Inst. Arts and Sciences, i. (1905) pp. 141–86.
† Trans. Entom. Soc. London, 1906, pp. 91–5.
‡ Zool. Jahrb. Abt. Anat., xxii. (1905) pp. 477–576 (1 pl. and 32 figs.).
§ Ann. Inst. Pasteur, xx. (1906) pp. 16–40.
‖ Zool. Anzeig., xxx. (1906) pp. 169–70 (2 figs.).

proximally an expansion of nerve-fibres inclosed in a special wall, and distally a darker "nucleus" in the middle of which lies a rod-like somewhat refractive body. The nerve-fibrils come into close association with this peculiar body, and distally a thin process passes to the hypodermis. Besides the eyes, the antennæ, the sensory hairs described by Weismann, the brown spot which Leydig regarded as a third rudimentary eye, and the organ described, there is also a minute chordotonal organ, so that the head is extremely well equipped.

Synonymy of Musca Marginalis.*—E. E. Austen clears up the synonymy of this much-described species. Its systematic position is now fixed in the genus *Pycnosoma*, in which there are two species, *P. marginale* and *P. chloropyga*. These, together with *Musca domestica*, it appears, were partly responsible for the spread of enteric fever among the British soldiers during the late war in South Africa.

Distribution and Biology of Anopheles.† — J. R. Adie and A. Alcock record the occurrence of *Anopheles* (*Myzomyia*) *listoni* in Calcutta in December and January. Some experiments were made in order to discover natural enemies of the larvæ. In one cage where there were twelve larvæ and a single rapacious larva of a dragon-fly (*Ceriagrion coromandelianus*) all the *Anopheles* larvæ disappeared, and an adult dragon-fly hatched out in due course.

Development of Ageniaspis Fuscicollis.‡—F. Silvestri has studied the development of this parasitic Hymenopteron, whose poly-embryony has been investigated by Marchal. It is an "endophagous" parasite of *Prays olcellus*.

In the maturation of the parthenogenetic ova, as in the fertilised, two polar bodies are formed. The whole of the protoplasm of the ovum does not take part in forming embryonic cells, for a polar portion, including the polar globules, assumes a protective and nutritive function as regards the embryonic portion.

Collecting Stylopidæ.§—Charles Dury gives a useful hint. In the genera *Xenos* and *Stylops*, the adult female is larviform and never leaves the body of its host (wasp, bee, etc.), but the male pupa projects. A wasp so infected should be confined in a jelly tumbler with a cheese-cloth cover over the top; in the bottom of the glass there should be placed a round bit of blotting paper and a piece of screen wire, raised up from the bottom. When the *Xenos* emerges it falls through the false bottom of wire. Otherwise the wasp would bite it in pieces. The wasp should be fed with jelly and water, put on the cheese-cloth cover in one small spot with a camel's hair brush.

Copulation and Oviposition in Hemiptera.‖—C. Gordon Hewitt has observed these phenomena in several aquatic genera. In *Nepa cinerea*, where there is a terminal respiratory siphon, the chief interest in

* Ann. Mag. Nat. Hist., xcix. (1906) pp. 301–4.
† Proc. Roy. Soc., Series B, lxxvi. (1905) pp. 319-21.
‡ Atti Rend. R. Accad. Lincei Roma (1906) pp. 650–7.
§ Ohio Nat., vi. (1906) p. 443.
‖ Trans. Entomol. Soc. London, 1906, pp. 87-90 (1 fig.).

the copulatory process lies in the mode of disposition of this siphon, which consists of two closely apposed grooved setæ. Coitus appears to last for some time, and the female does not appear to mind the presence of the male, as she goes on feeding. *Corixa* in oviposition emits a minute drop of fluid, which fixes the egg to the plant. The egg is then laid with the micropyle furthest away from the point of attachment, and the female swims away. The general conclusion arrived at from observations on the behaviour of these insects is that there does not appear to be any sexual selection in the Hemiptera—Cryptocerata.

Irish Collembola.*—G. H. Carpenter describes two new species of springtails of the family Entomobryidæ, viz. *Isotoma hibernica* sp. n., and *Entomobrya anomala* sp. n. The latter is somewhat aberrant in structure, forming in many respects a connecting link between typical members of its genus and *Orchesella*.

β. Prototracheata.

Australian Onychophora.†—Arthur Dendy points out that the correct nomenclature of the Australian species of Onychophora is as follows:—

1. *Peripatoides leuckarti* Saenger (with 15 pairs of walking legs; oviparous; characteristic of N. S. Wales, with a variety *occidentalis* Fletcher, in Western Australia).

2. *Ooperipatus oviparus* Dendy (with 15 pairs of walking legs; oviparous; characteristic of Victoria, but extending northwards to Queensland).

3. *Ooperipatus insignis* Dendy (with 14 pairs of walking legs; viviparous; characteristic of Tasmania and Victoria).

γ. Myriopoda.

Structure of Platydesmidæ.‡—F. G. Sinclair discusses some points in the anatomy of *Platydesmus mexicanus*, the extremely small head almost concealed beneath the tergal plate of the neck, a peculiar (visual) sense-organ on the head, the mouth-parts, the narrow intercalated dorsal plate on the segments, and the nervous system. The author calls attention to the great diversity of form in the Myriopod brain. He regards the Platydesmidæ as an aberrant group allied to the Polydesmidæ.

Studies on Scutigeridæ.§—K. W. Verhoeff has made a study of the Scutigeridæ in the Berlin Zoological Museum, and discusses their morphology, taxonomy, and "hemi-anamorphosis." Two new genera, *Podotherena* and *Tachytherena*, related to *Therenonema* and *Therenopoda*, are established.

δ. Arachnida.

Bovine Ticks as Carriers of Disease.‖—W. H. Dönitz discusses in particular the species of *Rhipicephalus* which are responsible for

* Scientific Proc. Roy. Dublin Soc., xi. (1906) pp. 39–42 (1 pl.).
† Zool. Anzeig., xxx. (1906) pp. 175–7.
‡ Quart. Journ. Micr. Sci., xlix. (1905) pp. 507–19 (1 pl.).
§ SB. Ges. Nat. Freunde Berlin, 1905, pp. 9–60 (1 pl.).
‖ Tom. cit., pp. 105–34 (1 pl.).

carrying the germs of Texas fever and African Coast fever in cattle. Twelve species are described, including *R. kochi* sp. n. The remarkable copulatory process, in which the proboscis of the male is inserted into the vulva, is discussed. The genus *Boophilus* of Curtice includes *R. annulatus* and *R. decoloratus*, which differ markedly, especially in their mode of life, from other species of *Rhipicephalus*. The author also describes *Hæmaphysalis neumanni* sp. n., *H. flava* Neumann, *Hyalomma ægyptum* L., *Amblyomma eburneum* Gerstäcker, and *Ixodes ovatus* Neumann.

Structure of Ixodes reduvius.*—Erik Nordenskiöld describes the skin and its glands, the circulatory and respiratory systems of this tick.

Revivification of Tardigrada.†—F. Richters reports on the revivification of species of *Macrobiotus*, *Milnesium*, and *Echiniscus* from dry moss. In some cases re-awakening on re-moistening occurred in 15–60 minutes after 9–22 months.

Genital Tracheæ in Chernetidæ and Acari.‡—A. C. Oudemans describes in *Cyta latirostris* an indubitable tracheal system, which has its origin in the vestibulum of the genital apparatus, and probably has an exclusively respiratory function. The ram's horn-like structures seen in connection with the genitalia in Chernetidæ have probably a tracheal origin, though the author does not therefore conclude that they are wholly respiratory.

ε. Crustacea.

Egg-Laying Habits of Cambarus affinis.§—E. A. Andrews describes the egg-laying of this American crayfish. In general they resemble those of *Astacus*. There are four periods of activity—cleansing, glairing, extrusion, turning. "The activities of the female include a prolonged use of special tools to cleanse the surfaces later covered by the secretions of the 'cement-glands,' a long continued maximum contraction of the abdomen, a habit of lying supine and externally inert during oviposition, and a long rhythmic alteration of poses associated with the fastening of the eggs to the abdominal appendages. After this follow the weeks of aeration and care of the eggs till they hatch." In the fastening of the eggs the secretion of the "cement glands" seems of chief importance, but local activities of the eggs may possibly play a part.

Phototropism of Larval Lobsters.‖—G. Bohn discusses the complex behaviour of larval lobsters in regard to light. (1) Hatched at night, they are in the morning drawn towards light. (2) But exposure to light changes this reaction, and in the course of the first day the larvæ come and go from illumined to obscure objects in the aquarium. (3) After several days they group themselves opposite the largest obscure surfaces. All the movements of repulsion and attraction and rotation take place rapidly and precisely, as if irresistible. The orientation in relation to light comes about by complex rotatory movements, varying according

* Zool. Anzeig, xxx. (1906) pp. 118–25 (8 figs.). † Tom. cit., pp. 125–7.
‡ Tom. cit., pp. 135–40. § Amer. Nat., xl. (1906) pp. 343–56.
‖ Comptes Rendus, cxli. (1905) pp. 963–5.

to external and internal conditions. It seems to the investigator that the eye functions, before the otocyst, as an equilibrating organ.

Macrura of the 'Hassler' and 'Blake.' * —E. L. Bouvier makes a preliminary report on some of the undescribed free-swimming Macrura of the American expeditions 'Hassler' and 'Blake.' Among the Penæidæ the most interesting type is *Neopenæopsis paradoxus* g. et sp. n., which has no exopodites on the last two pairs of limbs. Another instructive form is *Archipenæopsis vestitus* g. et sp. n., related to *Penæopsis* and *Hemipenæopsis*. A transition between *Artemisia* and *Haliporus* is represented by *Parartemisia* g. n. Among the Stenopidæ there is a new species of *Richardina* (*R. inermis*), which differs from the other three species in being without an armature of spines.

Meristic Variation in an Isopod.† —Seitaro Goto reports the occurrence of a supernumerary thoracic segment (eight instead of seven) in a species of *Ligia*. The occurrence of a supernumerary segment in a Malacostracan is very rare.

Hepatic Tubes of Anilocra frontalis.‡—A. Guieysse finds that in this Isopod the physiologically enigmatical "hepatic tubules" have peculiar cells in which the lobed nucleus enters into close connection with the cytoplasm.

Commensalism of Two Isopods.§—Carmelita Rossi calls attention to the occurrence of *Jæra kroyeri* M.-Edw. on the body of *Sphæroma serratum* Fabr. The occurrence of a species of *Jais* (*J. pubescens*) on another *Sphæroma* (*S. gigas*) has been previously recorded. The author thinks that parasitism is out of the question, and points out that the integument and limbs of *Sphæroma serratum* bore a notable number of Vorticellids and other Infusorians, which form the favourite and ordinary food of *Jæra*. Therefore the association is nearer commensalism (*convivenza*).

Nervous System of Copepoda.‖—C. O. Esterly communicates some facts regarding the peripheral and central nervous system in fresh-water Copepoda. Each æsthetask-bearing joint of the anterior antennæ of both male and female of *Diaptomus* contains a group of cells which stain with methylen-blue. It can be seen that peripheral processes arise from such cells, and unite into a single strand to enter the æsthetask. The so-called tactile bristles on the antennæ do not show such characters, but in the furcal bristles of a species of *Cyclops*, structures, probably nervous, have been found. The rostrum of *Diaptomus* is probably sensory in function. In several cases bipolar cells occur far back in the abdomen, whose central processes unite before entering the thorax and pass as a single fibre far forward towards the brain.

Halocyprids of San Diego.¶— Chancey Juday reports on the plankton Ostracods of San Diego belonging to the family Halocypridæ.

* Comptes Rendus, cxli. (1905) pp. 746–9.
† Annot. Zool. Japon, v. (1906) pp. 279–81 (1 fig.).
‡ Bull. Soc. Philom. Paris, v. (1905) pp. 207–11. See also Zool. Zentralbl. xiii. (1906) p. 207.
§ Zool. Anzeig., xxx. (1906) pp. 107–9.
‖ Univ. California Publications, iii. No. 1 (1906) pp. 1–12 (2 pls.).
¶ Op. cit., No. 2 (1906) pp. 13–38 (5 pls.).

He gives a diagnosis of the family and a key to the genera (*Archiconchœcia* Müller, *Conchœcia* Dana, and *Halocypris* Dana. Ten species are described, *C. ritteri* being new.

Annulata.

Sexual Reproduction in Æolosoma.*—Jas. A. Nelson describes the rare occurrence of sexual reproduction in this primitive Oligochæt. In a number of specimens ten were found with sex-elements; four contained ova only, three contained male elements only, three contained both. The spermatogenesis is discussed, and one point is especially noteworthy —the appearance of a large nucleolus in the spermatocytes of both orders and in the spermatids. This indicates the very unusual occurrence of a long resting stage between the two maturation-divisions, and also a long pause before the metamorphosis of the spermatid into the spermatozoon. It is not known what conditions determine the occurrence of sexual reproduction.

Ethology of Tubifex and Lumbriculus.†—F. von Wagner communicates some ethological notes on these Oligochæts. Thus *Tubifex*, much more than *Lumbriculus*, is an inhabitant of mud. Autotomy is much less important in *Tubifex* than in other related forms; its widespread abundance makes this capacity less necessary. The astonishing energy of *Tubifex*, which may continue in active movement for four hours without interruption, is commented on. The author discusses the highly developed autotomy of *Lumbriculus*, the tube-making of *Tubifex*, and the frequent association of the two forms. The excellent illustrations of *Tubifex* in its natural surroundings deserve special notice.

West Indian Polychæts.‡—H. Augener reports on a collection of about eighty Polychæts collected by the 'Blake.' About a third of the species were previously described by Ehlers in his "Florida Annelids" (1887). The majority of the species are West Indian and mid-Atlantic forms; four are known from the Mediterranean; about a dozen are known from mid-Europe and North Europe, and also for the most part from North American coasts; five are known also from the West African region. Twenty-one families are represented.

Artificial Parthenogenesis in Thalassema.§—George Lefevre finds that the ova of *Thalassema mellita* Coun, exposed for a short time to dilute solutions of acids, may undergo normal development, although the rhythm of division is more or less disturbed, and may give rise to normal larvæ. The reduced number of chromosomes, after normal maturation-mitoses, persists, and was repeatedly verified in late blastula- and gastrula-stages.

In some cases, however, only one polar body was extruded; in some cases neither was formed. Upon sectioning these eggs, it was found that either one or both maturation-mitoses had taken place well below the surface, without accompanying cytoplasmic division. Many abnormal

* Ohio Nat., vi. (1906) pp. 435–8 (5 figs.).
† Zool. Jahrb., xxiii. (1906) pp. 295–318 (1 pl.).
‡ Bull. Mus. Comp. Zool. Harvard, xliii. (1906) pp. 91–196 (8 pls.).
§ Science, xxiii. (1906) pp. 522–4.

cleavages and nuclear divisions without cytoplasmic divisions were observed, and ciliated bodies unlike normal embryos were often formed.

Nematohelminthes.

Rachis in Ovaries and Testes of Nematodes.* — Alfred Mayer extends the recent observations of Marcus, and finds that there are numerous nuclei in the rachis of the gonads of both sexes in *Ascaris megalocephala* and *A. lumbricoides*. He compares the rachis with the nucleated cytophore in the spermatogenesis of various invertebrates, such as *Clitellio*.

Anguillula intestinalis.† — Stursberg discusses the case of a German field labourer whose fæces showed the *Rhabditis* embryos of this Nematode. He had repeatedly drunk water from the cooling-canals of a manufactory in which foreigners were at work.

Ascaris halicoris.‡—Von Linstow describes *Ascaris halicoris* Baird from the pylorus of the dugong.

Cetacean Echinorhynchi.§—A. Porta gives a full account of the structure of *Echinorhynchus capitatus* von Linstow, from *Pseudarca crassidens* Gray and *Globicephalus svineval* Flower. Four other species from Cetaceans—*E. porrigens* Rud., *E. pellucidus* Leuck., *E. turbinella* Dies., and *E. brevicollis* Malm.—are compared with *E. capitatus*, and the author proposes to include the five in a new genus, *Bulborhynchus*.

Embryology of Strongylus filaria.‖—C. Struckmann gives an account of the oogenesis, spermatogenesis and fertilisation in this Nematode. In both oogonia and spermatogonia there are twelve chromosomes which form tetrads, equivalent to bivalent chromosomes. There are two large, two medium, and two small tetrads. The phases of ovum and sperm maturation agree in the behaviour of the chromatin as regards reduction. The tetrad forms of the first reduction spindle are characteristic and are comparable to the chromatic elements of *Ascaris*. In fertilisation the sperm does not after entering the egg penetrate far, but remains near the periphery, and here the male pronucleus is developed. The pronuclei arise mostly at opposite poles, and only approach the centre of the egg for the formation of the first segmentation spindle.

Platyhelminthes.

Sexual Organs and Development of a Tapeworm.¶—T. B. Rosseter gives some details regarding the generative organs in *Drepanidotænia undulata* (Krabbe). This tapeworm, which occurs in a number of avian hosts, in the present instance was found in *Turdus musicus*. The development of the 6-hooked embryo was followed within the uterus, where it

* Zool. Anzeig., xxx. (1906) pp. 289–97 (6 figs.).
† SB. Niederrhein. Ges. Nat. Bonn, 1905, Section B, pp. 28–9.
‡ Journ. and Proc. Asiatic Soc. Bengal, i. No. 10 (1905) pp. 258–60 (1 pl.).
§ Zool. Anzeig., xxx. (1906) pp. 235–71 (63 figs.).
‖ Zool. Jahrb. Abt. Anat., xxii. (1905) pp. 577–628 (3 pls. and 18 figs.).
¶ Journ. Quekett Micr. Club, 1906, pp. 269–74 (1 pl.).

finally "evolves itself into a medusiform body or 6-hooked brood. These six hooks, placed at equal distances, support the velum from the interior of the invaginated gastrula cavity." The author thinks his observations give support to the view that Cestodes have "possibly never advanced beyond a gastrula stage in their development."

New Species of Tapeworm.*—T. B. Rosseter describes *Drepanidotænia sagitta* sp. n., from *Anas boschas*. The scolex is pyriform and perforated at its base by a circular orifice. This is a naturally formed inverted cavity from whose sides spring the muscles which elevate and retract the rostellum. This organ is long, flexible, attenuated, and armed with sickle-shaped hooks. There are four oval suckers so placed around the scolex as to give the head an arrow-like appearance. The most distinctive internal feature appears to be the "spatuliform monotestis."

Some New and Little Known Trematodes.†—W. Nicoll comments on the neglect of the study of Trematodes in Britain, and offers some contributions. He describes *Echinostomum secundum* sp. n. from the intestine of *Larus ridibundus* and *L. argentatus*; *Zeugorchis acanthus* g. et sp. n., from the bursa fabricii and cloaca of *L. argentatus*, which differs widely from *Echinostomum*; *Levinsenia similis* (*Spelotrema simile*) Jagerskïöld; and *Psilostomum redactum* sp. n., from the intestine of *Gasterosteus aculeatus*.

Life History of a Trematode of the Oyster.‡—D. H. Tennant has elucidated some points in the early development of *Bucephalus haimeanus*, a parasite of the oyster. Experimental evidence has shown that *B. haimeanus* is a larval stage of *Gasterostomum gracilescens*. Germ-cells arise within the sporocyst wall of the latter, give off small cells which may be regarded as polar bodies, segment and develop into the cercaria of *B. haimeanus*. It is further shown in other cases that supposedly different species are physiological varieties of the same species. The presence of sporocysts and cercaria of *G. gracilescens* in the oyster prevents the formation of reproductive elements, and also renders the host incapable of withstanding adverse conditions. *B. haimeanus* thrives best in oysters living in brackish water. Its growth is inhibited by increased salinity.

Incertæ Sedis.

Life-History of Orthonectids.§—F. Mesnil and M. Caullery have studied *Rhopalura pelseneeri* and compared its life-history with that of Dicyemids. There is a phase of asexual multiplication in the host, in the form of plasmodia, whence sexual individuals arise at the expense of "cell germs." Then there is a phase of propagation, from one host to another, secured by the sexual individuals which are ciliated and produce ova. These develop, doubtless after fertilisation, in the interior of the body of the mother, into ciliated larvæ, known only in *R. ophiocomæ* Geard and *R. pelseneeri* C. and M., but doubtless of

* Journ. Quekett Micr. Club, 1906, pp. 275–8 (1 pl.).
† Ann. Nat. Hist., xvii. (1906) pp. 513–27 (2 pls.).
‡ Quart. Journ. Micr. Sci., No. 196 (1906) pp. 635–90 (4 pls.).
§ Comptes Rendus, cxli. (1905) pp. 774–6.

general occurrence. These larvæ are evidently the agents of infection of new hosts, where they give rise to plasmodia. It is suggested that the vermiform individuals (agamontes) in Dicyemids correspond to the plasmodia in Orthonectids, and the infusoriform individuals (hermaphrodites ?) correspond to the sexual individuals of Orthonectids.

Rotifera.

Retro-Cerebral Organ in certain Rotifers.*—P. Marais de Beauchamp describes a structure lying dorsal to the " brain " in representatives of Euchlaninæ, Rattulinæ, Colurinæ, Gastropodinæ, and Notommatinæ. It is a glandular organ, bifurcated in front at least, with two apical apertures, and forms a secretion which stains during life with neutral-red. In *Notommata* and related forms it is intimately connected with the brain and eye, and probably has a secondary sensory function. Its secretion has the form of bacteroid granules. In *Copeus* and *Eosphora* there are two auxiliary cells, which seem to be derived from the brain.

New Rotifers.†—James Murray figures and describes *Callidina vesicularis*, a new Bdelloid Rotifer from moss, characterised in particular by the possession of $\frac{4}{4}$ teeth in the jaws, six pairs of very large and prominent vibratile tags, and two blunt processes in first foot-joint, and small spurs, separated by wide interspace.

James Murray ‡ further describes, in a " List of Rotifera of the Forth Area," *Stephanops microdactylus*, a minute new species having a single long style on the dorso-posterior part of the body, and a long narrow foot ending in two very minute toes.

Raffaele Issel § describes *Notommata najas* var. *termalis*, a new variety which the author found living in various hot springs in Italy in company with the very rare *Euchlanis plicata* Levander, at temperatures ranging from 45°–87° C. No other species of Rotifers were found in these thermal waters.

Echinoderma.

Antarctic Echinoderms.‖—R. Kœhler makes a preliminary report on the forms collected by Charcot. They are very different from those of the 'Belgica' or 'Southern Cross' collections. The Asteroids are peculiarly interesting, e.g. *Ripaster charcoti* g. et sp. n., an Archiasterid characterised by the delicacy of the marginal plates, and *Cryaster antarcticus* g. et sp. n., remarkable in the complete absence of a dorsal skeleton —which requires a new family, Cryasterideæ. The author notes the absence of any similarity with Arctic Echinoderm fauna.

Holothurian Spicules.¶—W. Woodland gives an account of the development of the spicules of *Cucumaria*, of the mode of deposition of

* Comptes Rendus, cxli. (1905), pp. 961–2.
† Journ. Quekett Micr. Club, ix. (1906) pp. 259–62 (1 pl.).
‡ Ann. Scot Nat. Hist., 1906, pp. 89–93 (5 figs.).
§ Atti Soc. Ligustica Sci. Nat. e Geogr., xvii. (1906) pp. 1–72 (1 pl.).
‖ Comptes Rendus, cxlii. (1906) pp. 113–15.
¶ Quart. Journ. Micr. Sci., No. 196 (1906) pp. 533–59 (3 pls.).

the spicules in *Thyone fusus*, and a note upon a stage in the scleroblastic development of the plate-and-anchor spicules of *Synapta inhærens*.

Cœlentera.

Rheotropism in Hydroids and Bugula.*—P. Hallez has subjected various hydroids for 4–75 days to variable currents of water, with controls in vessels not agitated. He has experimented with species of *Obelia*, *Sertularella*, *Hydrallmania*, *Antennularia*, etc. The results are not affected by the rates of the current. One of the chief results is an abundant production of hydrorhizæ, which, by budding rapidly, form new colonies. In *Bugula*, too, an exaggerated production of roots is induced.

Fresh-water Medusa in River Niger.†—E. T. Browne records the occurrence in the river Niger of *Limnocnida tanganicæ*, a fact of some interest in view of the distance of this river from the Great African Lakes. He thinks that with a sea stretching across the Soudan in the Eocene period one can account for the presence of *Limnocnida* in both these regions. This solution of the problem removes the need to speculate about the Medusæ ascending the Niger from the Atlantic and migrating across Africa.

Limnocodium at Munich.‡—E. Boecker reports the occurrence of the fresh-water Medusoid *Limnocodium* in the Victoria Regia tank in the Botanic Gardens at München. The specimens seemed to be exclusively males. The hollow tentacles did not seem to have their bases imbedded in the jelly, as Günther stated. Infusoria, algæ, amœbæ, etc., were observed in the stomach.

Free-living Variety of Adamsia rondeletii.§—José Rioja y Martín describes some colour varieties of this common sea-anemone, and notes also that it often occurs altogether apart from mollusc-shells and the hermit-crab, namely, on *Zostera marina*. Linares has named this free-living variety, *libera*.

Californian Shore Anemone.‖—H. B. Torrey described *Bunodactis xanthogrammica*, which has a wide range along the entire Pacific coast of North America, and shows considerable variability. It has been described under at least four different specific and five generic names, but the author clears up the synonymy. The characteristic green colour of the species is found only in individuals exposed to the sun ; it is due to a unicellular alga in the endoderm of the column wall, mesenteries and tentacles. Under wharves or in caves the algæ, though present, do not develop so luxuriantly, and the polyps are correspondingly pale. The material for the illustrative plate was destroyed in the recent fire in San Francisco, but the plate will be forthcoming later on.

* Comptes Rendus, cxli. (1905) pp. 840–3.
† Ann. Mag. Nat. Hist., xcix. (1906) pp. 304–6.
‡ Biol. Centralb., xxv. (1905) pp. 605–6.
§ Boll. R. Soc. Españ. Hist. Nat., v. (1905) pp. 457–9 (1 pl.).
‖ Univ. California Publications, iii. No. 3 (1906) pp. 41–5 (1 pl.).

Role of Mucus in Corals.*—J. E. Duerden finds that the outer surface of coral polyps is covered with a thin mucus layer, which entangles objects falling on it. When first extruded it is thin and watery, becoming firmer later. From time to time it gets broken up into shreds, which are wafted off the disk by the exhalant currents from the stomodæum, carrying with it adherent foreign particles. Nutritive substances and extractives placed upon the polyp increase the amount of mucus, and also result in an opening of the mouth and the institution of an inhalant stomodæal current by reversing the dominant outward beat of the stomodæal cilia. At the same time, the mucus is drawn down along with its entangled nutritive or non-nutritive particles into the stomodæum. Ingestion in coral polyps is thus purely mechanical, depending upon whatever substances are capable of producing an inward beat of the cilia, the opening of the mouth, and the exudation of mucus. An inhalant current being established, objects are carried into the polypal cavity without regard to their nutritive value, and independently of any peristaltic motions on the part of the stomodæum.

Japanese Alcyonarians.†—W. Kükenthal gives diagnoses of a number of new Japanese species:—*Anthelia japonica*, *Clavularia* (three sp.), *Nidalia* (five sp.), *Alcyonium gracillimum*, *Dendronephthya* (six sp.), *Gersemia marenzelleri*, *Eunephthya japonica*, *E. spiculosa*, *Siphonogorgia dofleini*, and *S. splendens*.

New Species of Semper's Larva from the Galapagos Islands.‡—Harold Heath describes under the title *Zoanthella galapagonensis* a new species of Semper's larva, but is unable to offer any suggestion as to its relationships.

Porifera.

Bengal Variety of Spongilla lacustris from Brackish Water.§—Nelson Annandale describes *Spongilla lacustris* var. *bengalensis* n. from brackish water at Port Canning in Lower Bengal. There is a total absence of branches. The spicules most nearly resembled those of Pott's variety *montana*. The gemmules were very distinctly of two sizes, scattered indiscriminately, not grouped, and without large air-cells. The green colour was due to a multicellular alga. Enormous numbers of gemmules formed a scum on the surface of the pools, and some seemed to have been carried to a distance by the wind.

Protozoa.

Atlanticellidæ.‖—A. Borgert establishes a new family of Radiolarians (Tripylea) which he calls Atlanticellidæ. The diagnosis reads:—"Tripylea, with a free vesicular central capsule not inclosed in skeleton; the skeleton is absent, or forms an oval appendage of the central capsule;

* Quart. Journ. Micr. Sci., No. 196 (pp. 591–614).
† Zool. Anzeig., xxx. (1906) pp. 280–9.
‡ Tom. cit., pp. 171–5 (4 figs.).
§ Journ. and Proc. Asiatic Soc. Bengal, ii. (1906) pp. 55–8 (1 fig.).
‖ Ergebn. Plankton Exped., iii. (1906) pp. 117–28.

in the latter case there is in the main axis a hollow, clapper-like, median portion composed of hollow, but peculiarly chambered spines; the spines are disposed singly or in pairs in cruciate arrangement around the main axis." There is only one main opening in the central capsule; parapylea are absent. It is the presence of a phæodium-like pigment-mass that points to affinity with the Tripylea. The family is represented by the genus *Atlanticella*, with three species. There seem to be near affinities with the Medusettidæ. The habitat of the Atlanticellidæ is especially in the deeper regions of the Atlantic; they appear to be absent in the cold northern regions.

Xenophyophoræ.*—F. E. Schulze discusses a peculiar group of Rhizopods from abyssal regions, e.g. *Psammetta erythrocytomorpha*, *Psammina globigerina*, *Stannoma dendroides*. They are not sponges, as has been suggested, but represent a group of Protozoa within the Rhizopod class, and near Foraminifera. The term Xenophyophoræ refers to the characteristic utilisation of extrinsic foreign bodies such as the spicules of Tetraxonid sponges.

Dimorphism of English Nummulites.†—J. J. Lister finds, from an examination of the Nummulites of the Eocene beds of the Isle of Wight and Hampshire, proof of the existence of alternating members of "a pair" of forms in the life-history of a species. The two modes of reproduction come into marked contrast, the asexually produced megalospheres being approximately proportional in size to the protoplasmic volume of the parent while the microsphere probably arising as a zygote is uniformly small throughout. In several of the species examined, as the microspheric member of the cycle preponderates in the life-history, the megalospheric member decreases, not only in proportion to the size of the microspheric form, but in proportion to the megalospheric members of other species in which the two forms attain approximately equal sizes.

Barium Sulphate in a Rhizopod.‡—F. E. Schulze and Hans Thierfelder note that in a peculiar abyssal Rhizopod, *Xenophyophora*, the cytoplasm includes minute refractive granules which consist of barium sulphate with traces of calcium sulphate. The only other known case of barium in organisms is in some marine plants ("Forchhammer").

Life-History of Hypotrichous Infusoria.§—L. L. Woodruff has investigated this in *Oxytricha*, *Pleurotricha*, and *Gastrostyla*. In one culture as many as 860 generations were attained. All the cultures gave incontestable proof that the forms studied pass through cyclical periods of greater and less general vitality as measured by the rate of division. The periods of depression lead to death if the culture is subjected continuously to the same environment. Minor fluctuations, termed rhythms, occur in the division rate; they are periodic rises and falls due to some

* Wiss. Ergebn. Deutsch. Tilfsee Exped. Valdivia, xi. (1905) pp. 1–55 (8 pls.). See also Zool. Zentralbl., xiii. (1906) pp. 238–42.
† Proc. Roy. Soc., Series B, lxxvi. (1905) pp. 298–319 (3 pls.).
‡ SB. Ges. Nat. Freunde Berlin, 1905, pp. 2–4.
§ Journ. Exper. Zool., ii. (1905) pp 585–632 (3 pls.).

unknown factor in cell-metabolism, from which recovery is autonomous. A cycle extends over a varying number of rhythms, and ends in extinction of the race unless it is "rejuvenated" by conjugation or changed environment. Seasonal and temperature changes have no apparent influence on the cyclical fluctuations of vitality. Variation in temperature, however, undoubtedly affects somewhat the daily rate of division, if not directly at least through the food supply. The physiological and structural changes which appear at periods of low vitality are described. It is also noted that under varying conditions structural modifications occur which are in no way abnormal, and that those observed most frequently in "wild" Infusoria are not so constant as is usually supposed.

Leptophrys.*—W. A. Kepner describes a form which, except for the absence of nuclei and the variable size of the vacuoles, corresponded with *Leptophrys elegans*, described by Hertwig and Lesser. It is suggested that these investigators mistook ingested monads for nuclei. Locomotion is effected by more or less active amœboid movements. "An active large individual tosses itself about very much as a cloud of smoke is distorted by a current of air." After the animal gorges itself with diatoms, desmids, and monads, it encysts. Division into two was observed, but no trace of a nucleus was seen. As Penard suggested, it seems likely that *Leptophrys* is but a synonym for a species of *Vampyrella*.

Studies on Peridineæ.†—Géza Entz, junior, gives an account of the Peridineæ captured in the plankton of Quarnero and Quarerola, enumerating fifty-nine forms, and discussing the variations of species of *Ceratium*. He gives a detailed account of the plates of *Phalacroma jourdani* and *Ceratocorys horrida*, and shows the homologies of the plates in Phalæromeæ and Ceratiæ. The process of division in these families is also discussed.

Identity of Surra and Mbori.‡—A. Laveran has shown that the Trypanosomiasis which Cazalbon called *Mbori*, and which chiefly attacks dromedaries in French Soudan, is due to the same parasite as Surra (*Trypanosoma evansi*). Structurally, the two Trypanosomes are the same, and animals immune to Surra are immune to Mbori, and *vice versa*. The Trypanosome of Mbori is, however, slightly less virulent than that of Surra.

Parasite of Acute Exanthema.§—J Siegel has found in the whole group of so-called acute exanthematous diseases a flagellate parasite, with naked body, at least two distinct nuclei, and 1–3 flagella. The multiplication occurs by repeated division of the nucleus (sporulation), and also by longitudinal division. In *Vaccinia* the parasites not only occur in the affected parts of the skin, but swarm in the blood. Guarnieri has given the name *Cytorrhyctes* to these organisms.

* Amer. Nat., xl. (1906) pp. 335–42 (8 figs.).
† Math. Nat. Ber. Ungarn., xx. (1905) pp. 96–144 (66 figs.).
‡ Comptes Rendus, cxli. (1905) pp. 1204–7.
§ SB. Ges. Nat. Freunde Berlin, 1905, pp. 195–7 (1 fig.).

Life-History of Trypanosoma balbianii.*—W. S. Perrin gives an account of the life-cycle of this parasite of the oyster. With the exception of the growth of fresh individuals from the cysts, the whole developmental cycle takes place in the gut of a single host. In the crystalline style the Trypanosomes undergo longitudinal division as the normal method of multiplication. When the style disappears, gametes are formed and conjugation follows. Intra-epithelial stages in the gut do not appear to occur. Transmission of the parasite appears to take place by cysts alone.

Development of Hepatomonas of Kala-azar.†—L. Rogers has succeeded in developing the Leishmann-Donovan body in acidified blood with much more uniform results than in his earlier experiments, where citrated blood was used. He has absolutely failed to find any indications of an undulating membrane or of the migration of the micronucleus such as Novy and MacNeil witnessed in the development of bird trypanosomes. The conclusion is arrived at, that the organism is not a trypanosome, but belongs to the order Hepatomonas. A relatively low temperature (22° C.) is essential to development, which would indicate that infection is only likely to take place in India during the colder part of the year.

Sporozoon from Mucous Membrane of Human Septum nasi.‡—E. A. Minchin and H. B. Fantham describe *Rhinosporidium kinealyi* g. et sp. n., from a tumour in the nose of a native patient at the Medical College Hospital, Calcutta. The new parasite is an annectant form, which shows marked affinities with the typical Neosporidia and also with the simpler Haplosporidia. Amœboid trophozoite stages in the submucous connective tissue increase in size, form cyst-walls, and give rise to uninucleate pansporoblasts, each of which develops a spore-morula. In many cases the cysts burst and scatter the spore-morulæ in the surrounding tissue. This probably represents the usual method of endogenous reproduction.

The order Neosporidia should be extended to include *Rhinosporidium* and the Haplosporidia, and may then be subdivided into (1) Cnidosporidia (Doflein), with pole-capsules in the spore (Myxosporidia sens. strict., Microsporidia, and (?) Sarcosporidia); and (2) Haplosporidia, without pole-capsules in the spore, including *Rhinosporidium* and other forms previously referred to this section.

Observations on Gregarines.§—H. M. Woodcock gives an account of investigations on *Diplodina* (*Cystobia*) *irregularis* Minch., parasitic in *Holothuria forskali*, on *D.* (*C.*) *minchinii* Woodcock, from *Cucumaria pentactes* and *C. planci*, and on the trophozoites of *Diplocystis schneideri* from a new host, *Periplaneta orientalis*. A fairly complete account of the life-history of *D. irregularis* is given. This species and *D. minchinii* are quite motionless forms. Each adult is really a "couple," *Diplodina* being a neogamous Gregarine, or one in which precocious association

* Proc. Roy. Soc., Series B, lxxvi. (1905) pp. 368–75.
† Op. cit., lxxvii. (1906) pp. 284–93 (1 pl.).
‡ Quart. Journ. Micr. Sci., xlix. (1905) pp. 521–32 (2 pls.).
§ Op. cit., No. 197 (1906) pp. 1–100 (6 pls.).

occurs. The phenomenon of association in general is discussed, the conclusion arrived at being that it is not a primitive but an acquired condition. The power of cytotactic attraction has become so developed and specialised in Gregarines, that it is now most probably necessary before sporulation can take place.

Castration due to Gregarines.*—G. Smith gives some notes on the life-history of *Aggregata inachi* sp. n. No trace of conjugation prior to encystment, nor of two nuclei together in one cyst, was found. Amongst the sporozoites found free in the body of the crab a tendency to form associations was noted. The presence of the parasite in the male *Inachus* is associated with the occurrence of external hermaphrodite characters and with the disintegration of the testis, only the vesiculæ seminales remaining. The assumption of the hermaphrodite characters would appear to take place at the moult following the liberation of the sporozoites into the body cavity.

Structure and Life-History of Pleistophora periplanetæ.†—W. S. Perrin gives some particulars regarding this Myxosporidian parasite of *Periplaneta orientalis*. There are two very definite phases in the life-history: a schizogonous phase, characterised by almost excessive multiplication, with a view to auto-infection; and a sporogonous phase, characterised by the cessation of growth and trophic activity, and the formation of resting spores. This by no means agrees with Schaudinn's division of the Sporozoa, where the Myxosporidia are placed in the Neosporidia, in which spore-formation continues during the trophic phase. Another point of interest in the life-history of *Pleistophora periplanetæ* is afforded by the existence of residuary nuclei, which, together with the protoplasm of the pansporoblast, die off, while sporulation is being effected. The author regards it as possible that these residuary nuclei represent reduction bodies.

Spirochæte pallida and Syphilis.‡—C. Thiesing adduces various considerations which lead him to doubt whether this form is ætiologically connected with syphilis, and whether it is a protozoon. He regards it as a harmless saphrophyte, and as a plant, not an animal.

* Mitth. Zool. Station Neapel, xvii. (1905) pp. 406–10 (1 pl.).
† Quart. Journ. Micr. Sci., No. 196 (1906) pp. 615–33 (2 pls.).
‡ SB. Ges. Nat. Freunde Berlin, 1905, pp. 205–17 (1 pl.).

BOTANY.

GENERAL,

Including the Anatomy and Physiology of Seed Plants.

Structure and Development.

Vegetative.

Winged Stele in some Leguminosæ.*—Ph. van Tieghem has investigated the stele of certain Leguminosæ, and finds among the subtribe Spartieæ the normal type and three modifications, viz. (1) stele winged by the pericycle; (2) stele without wings, but accompanied by meristeles derived exclusively from the pericycle; (3) winged stele accompanied by meristeles derived exclusively from the cortex. Each of these modifications is found in several genera, e.g. the first in *Erinacea* and the Furze, the second in *Sarothamnus* and *Spartium*, which are thus shown to be nearly related to one another. On the contrary, certain genera share their species among these modifications and the normal type; the species of these genera are therefore more remote from one another than would be expected for members of the same genus.

The author suggests that where the flower and fruit show little agreement, e.g. in the Brooms and Trefoils, there should be a thorough investigation of the vegetative structure, especially of the stem; species with different structure should be placed in different genera; and also, perhaps, where flower and fruit permit, those with the same structure should be united in the same genus.

Reproductive.

Pollen-Grain of Picea excelsa.†—J. B. Pollock finds that in the pollen-grain of *Picea excelsa* the prothallial cells vary in number from one to three; the former obtains in the majority of cases, while the latter is rare. The position varies, but is usually in a continuous row with the stalk cell and central cell. Since the membranes of prothallial cells sometimes persist after the disappearance of the protoplasm, they are then probably of cellulose. In double pollen-grains, the 3–4 cells lying along the dorsal side are not to be regarded as a prothallium of unusual size, but as the smaller portion of a pollen-grain divided into two unequal portions, each of which is a potential antheridium. The cells of the larger portion are similar to those in a typical pollen-grain; the smaller portion varies more, but has a distinct resemblance to the typical antheridium.

The author concludes that variation in the pollen of Gymnosperms and of Angiosperms indicates reduction by gradual modification, due to disuse of vanishing structures. Suppression of the male gametophyte in

* Journ. de Bot., xix. (1905) pp. 185–97.
† Amer. Nat., xl. (1906) pp. 253–81 (1 pl.).

Gymnosperms is advantageous where photosynthesis is impossible. The division of the second male nucleus in the egg of some Gymnosperms, and its fusion with the segmentation nucleus in *Abies balsamea*, favours the view that the endosperm of Angiosperms is a modified gametophyte. Extremes in variation in the male gametophyte are found, on the one hand, in *Araucaria* with 20–44 cells, and, on the other, in *Cryptomeria japonica*, which not only has no vegetative prothallium, but the wall between the tube nucleus and the primary spermatogenous nucleus is transitory.

Development of the Pollen-Grain and Anther in Onagraceæ.*— R. Beer finds that in the pollen-grains of some Onagraceæ the young cell-membranes contain cellulose and pectose, but the sporogenous cell-membranes gradually come to be formed only of pectose. The pollen-mother-cell wall is of pure callose. The first two divisions of the pollen-mother-cell have seven chromosomes, afterwards there are fourteen. The first membrane formed directly by the protoplast is of pectose, deposited upon but distinct from the callose wall. Within this membrane a secondary thickening of pectose is formed. The interstitial bodies are special, thin areas on the first pollen-membrane, which are afterwards covered with mucilage ; later on, the latter may give rise to a dense, closing disk, as in *Œnothera*, or to laminæ, as in *Gaura*. Both the first pollen-wall and the secondary thickening layer are attached to the protoplast when first developed, but the greater part of subsequent growth of both membranes takes place by intussusception, after they are completely separated from the protoplast. The material required for their growth is derived from the protoplast, which when nearly exhausted is replenished by the disintegrated nuclear material of the tapetum. If this material is insufficient, further development ceases. The pollen nucleus remains in connection with the interstitial bodies by means of cytoplasmic threads, and just here the intine starts growth. In *Gaura Lindheimeri* and *Epilobium tetragonum* the intine contains both pectose and cellulose, but in *Œnothera* cellulose is almost or entirely absent. The interstitial disk and laminæ are eaten away, suggesting the action of an enzyme. The mature pollen-grains are held together by fibrils derived from the mother-cell wall.

Physiology.

Nutrition and Growth.

Ascent of Sap.†—A. Ursprung has experimented with beech stems, and draws the following conclusions as to the part played by the living cells in the ascent of sap. All experiments upon stems, pedicles, etc., tend to show that living cells assist in the production of force for raising the sap, and that the co-operation of the living cells of the wood is necessary for a long time. In older beech twigs, the living cortical cells have no influence on the sap ascent, and even in the youngest parts their influence cannot be important. For the necessary transmission through the length of one decimetre, only a very small

* Beih. Bot. Centralbl., xix. Abt. 1 (1906) pp. 286–313 (3 pls.).
† Jahrb. wiss. Bot., xlii. (1906) pp. 503–44.

fraction of the conducting tissue is needed if the wood-cells of the portion in question are living; while the whole of the conducting tissue does not transmit sufficient water if these cells have been destroyed.

Function of Silica in the Nutrition of Cereals.*—A. D. Hall and C. G. T. Morison, as the result of investigations on barley, conclude that silica, although not an essential constituent of plant food, plays a part in the nutrition of cereals, such as barley, which contain normally a considerable proportion of silica in their ash. The effect of a free supply of soluble silica is manifest in an increased and earlier formation of grain, and is thus similar to the effect of phosphoric acid. The silica acts by causing an increased intake of phosphoric acid, to which the observed effects are directly due. There is no evidence that the silica within the plant causes a more thorough utilisation of the phosphoric acid that has already been assimilated, or itself promotes the migration of food-materials from the straw to the grain.

Physiology of Germination of Pollen.†—L. Jost finds that germinating pollen-grains may be placed in three classes. (1) Those requiring nothing but water for germination, much mineral matter being injurious. To this group belong Grasses, which can only germinate in minute quantities of pure water. (2) Those requiring a very dilute solution of a definite chemical substance, which is contained in the stigma. In a few cases this substance is lævulose, in others organic acids, but in most cases it is unknown. (3) Those which germinate only in a sugar solution of definite concentration. In this case it is still unknown whether the sugar is nutritive, or whether it prevents excessive absorption of water owing to its osmotic properties. It may act like lævulose, or it may neutralise the poisonous effects of certain mineral substances, or it may exercise both these functions.

Similar results may be expected in connection with the germination of fungus spores.

Effect of Calcium Salts on Sphagna.‡—H. Paul gives a preliminary account of his observations on the effect of lime-salts upon *Sphagna*. He reviews the work of previous authors, notably that of C. A. Weber, from whom he differs entirely. Weber holds that calcium salts are not inimical to the nutrition of *Sphagna*, but that he has found them to flourish, and one species to fruit, even when irrigated with water rich in calcium carbonate. Paul, on the other hand, finds *Sphagna* very sensitive to solutions of calcium carbonate, though the species vary in this respect. Calcium sulphate they can tolerate in fairly large quantities. Details of Paul's experiments are promised in a further paper.

Fungi in Relation to Atmospheric Nitrogen.§—Berthold Heinze has conducted a series of experiments with various fungi on artificial culture media to test their power of assimilating nitrogen from the air, and so aiding in the enrichment of the soil. He comes to the conclusion

* Proc. Roy. Soc., Series B, lxxvii. (1906) pp. 455–77.
† Ber. Deutsch. Bot. Gesell., xxiii. (1906) pp. 504–15.
‡ Op. cit., xxiv. (1906) pp. 148–54.
§ Ann. Mycol., iv. (1906) pp. 41–63.

that though they do not directly collect nitrogen, yet, indirectly, they are of immense importance, as they furnish carbon material in the form of mannite, glycogen, etc., to the nitro-bacteria. The fungi experimented with were *Phoma Betæ*, *Aspergillus niger*, *Penicillium glaucum*, and *Mucor stolonifer*.

Irritability.

Effect of Light on Green Plants in absence of Carbon-dioxide.*— Jules Lefèvre has experimented with *Lepidium sativum* grown in artificial soil containing amido-compounds, and watered with water free from CO_2. One set of plants was placed under a bell-jar, in presence of baryta, and in full sunlight, while a second set was under similar conditions, but in darkness. The dry weight of the first set was greatly increased compared with the previous dry weight when grown in air under similar conditions; the second set died in a week, and its weight was slightly less.

The author concludes that the synthesis performed by green plants in absence of CO_2, and in an amido-soil, becomes impossible in the absence of light; also, this synthesis is essentially a chlorophyll function.

Modifications of Tropical Plants in changed Surroundings.†— D. Bois and J. Gallaud have investigated the reason for deterioration in the commercial products of such plants as *Cinnamomum Camphora*, *Ficus elastica*, etc., when removed from their native habitat to surroundings which appear to be favourable to their cultivation. Their experiments were carried out upon various species of *Euphorbia*, and they conclude that there is no ground for attributing the change to accidental, individual variations. They find that in both the secretory and supporting tissues (which are the chief sources of the commercial products), marked and rapid changes occur, directly resulting from differences in external conditions, such as heat, humidity, etc. More attention must be paid to these points, if better success is to attend the acclimatising of such plants.

Action of Sulphur-dioxide on Plants.‡—A. Wieler finds that different plants and organs are unequally sensitive to sulphur-dioxide, but that all plants within 8 kilometres from the source of pollution have the dioxide in their leaves. It enters through the stomata, and exerts an adverse influence on photosynthesis, owing to its direct action on the chloroplasts. Transpiration is unaffected. Injured plants decrease in height, and have premature autumnal coloration and leaf-fall. The author considers that the dioxide unites with metabolites, especially aldehydes, with liberation of sulphuric acid, and to the latter the injury is due. Indirectly the dioxide affects the soil by removal of its basic constituents, thus causing an accumulation of humic acids. Plants exposed to the action of a high percentage of the dioxide for a short time are acutely affected and past remedy. Those under the action of a low percentage for a long time exhibit the same characters as when

* Comptes Rendus, cxli. (1905) pp. 1035–6.
† Tom. cit., pp. 1033–35.
‡ Berlin: Borntraeger, 1905, vii. and 427 pp. See also Nature, lxxiii. (1906) pp. 385–6.

suffering from defective nutrition; application of manures, especially basic ones, is recommended as a remedy.

Chemotropism of Fungi.*—Harry R. Fulton gives a preliminary sketch of the views held and the results obtained by previous workers in this field of research. He carried out his own experiments with some fourteen fungi, parasitic and saprophytic. He employed capillary tubes filled with certain chemical substances, to test the influence of the substances on germinating spores. He also used the mica-plate method, piercing the plate with holes, and coating the under-surface with gelatin mixed with the test solution. From all these experiments he concluded that positive chemotropism scarcely exists. All of the fungi tested showed a tendency to turn away from a medium in which hyphæ had grown previously. Various fungi showed positive hydrotropism, while, in some cases, an overabundance of moisture caused a negative reaction. Fulton considers that the drying up of the moisture in which spores have germinated on the leaf, may be the factor that impels growth towards the stomata.

M. Racibowski † has grown *Aspergillus niger* in solutions containing various chemicals, but chemomorphism, he found, was induced only by thiosulphate, chloroform, and iodine. In thiosulphate solution the fungi is not poisoned, but no spores are produced. The conidiophore is formed, but sulphur drops congregate in the end of the hyphæ and hinder further growth. The plants grown in chloroform fructified to four generations. The growth of the hyphæ was, however, considerably affected; swollen cells were found full of protoplasm, the ends of the hyphæ were slender, and bore repeatedly forking branches. Spores were numerous, and the sterigmata of old conidiophores became globose at the ends. In weak solutions of iodine, growth was not materially altered; in a stronger mixture, no spores were formed, and abnormal growths of the filaments took place. Very large cells were found filled with protoplasm, and the membrane gradually thickened. Iodine reacted similarly on the growth of *Thamnidium elegans*.

Chemical Changes.

Behaviour of Plants towards Aluminium.‡—W. Rothert finds that plants take up aluminium in varying quantities if in suitable form, such as soluble salts and certain insoluble ones such as phosphate. The whole or greater part is retained in the roots. The small amount of suitable salts present in soil accounts for the presence of so little aluminium in plants. Soluble salts act injuriously except in very dilute solutions, also in specifically large quantities, yet plants often take up surprisingly large quantities of soluble salts, if the anion has no injurious effects (e.g. chloride). In some cases small quantities of aluminium salts exert a stimulating effect on plant development.

Aluminium can only be taken out of solution into tissues up to a fixed limit of concentration, which is independent of the concentration

* Bot. Gazette, xli. (1906) pp. 81–108.

† Bull. Acad. Sci. Cracovie, No. 10 (1905) pp. 764–78. See also Bot. Centralbl., ci. (1906) pp. 499–501.

‡ Bot. Zeit., lxiv. (1906) pp. 43–52.

of the surrounding solution and apparently also of the nature of the solution. Once taken up it is retained for some time.

Acid Excretion of Roots and Fungi.*—Gustav Kunze finds that the roots of higher plants do not excrete mineral acids; that the solvent action of the soil is due to organic acids alone, and as the amount of acid in many plants is infinitesimal, the plant relies on mycorhiza for the desired effect. By cultures of roots and hyphæ on marble he found that the latter had pierced deeper into the stone; he found also that humic acid played only a small part in the corrosion of minerals as compared with fungus hyphæ. He examined further the action of lichens on rocks. Among granite lichens it was discovered that the mica constituent suffered least from hyphæ. By growing *Penicillium* on litmus paper soaked in a nutrient solution he was able to determine the abundance of the acid, and that it was oxalic acid. Plant roots grown in the same conditions gave only a slight acid reaction on the paper. Hence he concludes the enormous importance of fungus hyphæ to the higher plants.

General.

Colour as an Attraction for Bees.†—G. Bonnier has experimented with bees for the purpose of testing whether the colour of flowers is the source of attraction. The author considers that previous workers have not given sufficient consideration to the social organisation of bees. He finds that among the workers leaving the hive are some which seek for honey, etc., and then point it out to the rest of the colony. These seekers are very numerous in the early morning, but later on they become plunderers. If honey, placed on variously coloured cards, is set near the hives in early morning, the seekers soon discover it; if it is later, when the seekers are less numerous, the plunderers will continue their appointed tasks, and the honey will remain untouched for a long time. These results are independent of the colour of the cards. All experiments tend to show that when bees have taken up their work for the day, they are usually unaffected by honey, etc., even if placed on conspicuously coloured flowers or cards in the vicinity of their labours.

CRYPTOGAMS.

Pteridophyta.

(By A. Gepp, M.A., F.L.S.)

Botrychium Lunaria.‡—H. Bruchmann gives detailed observations on the prothallium and sporophyte of *Botrychium Lunaria*. Whereas *Ophioglossum vulgatum* is propagated by numerous suckers, this method of growth is lacking in *B. Lunaria*: every sporophyte is the direct product of a gametophyte. Hence the minute prothallia must be sought with a lens beneath the surface where a sporophyte has lately shed its spores; it is useless to search beneath young plantlets, for these have

* Jahrb. wiss. Bot., xlii. (1906) pp. 357–93.
† Comptes Rendus, cxli. (1906) pp. 988–94.
‡ Flora, xcvi. (1906) pp. 203–30 (2 pls.).

already lived for some years underground and have lost all connection with the prothallia. After an allusion to the previous work of Irmisch, Campbell, and others, the author describes how and where he gathered his own material; and then discusses in detail the structure of the gametophyte and sporophyte, the latter being treated from three points of view—the older plant, the embryo plant, and the rare occurrence of branching.

North American Ferns.*—B. D. Gilbert gives an account of the North American varieties of *Polypodium vulgare*, founded on a comparison with critical specimens from Europe supplied by Druery and Christ. He describes 15 varieties and forms, and arranges them in four groups according to whether the fronds are normal or branched or crested, or have the pinnæ more or less lobed. One variety and three forms are new.

B. M. Rooney † describes the "resting" of *Botrychium*, and the results of her observations on *B. Virginianum*. On each sterile plant, even in the bud, she found the abortive sporangium, which differs in size, shape, and colour from the healthy fruiting sporangium of fertile plants. She believes that the number of years for a plant to be fruitful or sterile varies; there is no regular alternation. No such abortive sporangium was found on *Ophioglossum vulgatum*.

W. N. Clute ‡ describes briefly a form of *Osmunda cinnamomea* which differs slightly from var. *incisa* Hunt, and is designated by the author as var. *bipinnatifida*.

W. C. Dukes § records *Botrychium biternatum* from a locality west of Mobile, Alabama, and gives a short account of its growth from August to April.

W. N. Clute,‖ criticising certain customs of botanical nomenclature, especially the citation of authors' names—one for the original species, as well as another for the latest combination of genus and species—takes exception to sundry species ascribed to the recently founded *Sceptridium* on the score that they merit only varietal rank. He also describes the small *Polypodium piloselloides*¶ common in the West Indies. His check list ** of North American fernworts is continued from *Trichomanes* to *Asplenium*.

E. J. Winslow †† records some objections to the distribution assigned to the species of *Botrychium* in the first instalment of the check list above mentioned.

W. Scott's ‡‡ instructions on the cultivation of ferns from their spores are reproduced from "Gardening."

Exotic Ferns.§§—W. R. Maxon describes a new species of *Lycopodium* from Guatemala, under the name of *L. dichaeoides*. It is related to *L. aqualupianum*, and is represented in the collection of O. F. Cook and R. F. Griggs by No. 251, and in that of Robert Hay by No. 3268.

* Fern Bulletin, xiv. (1906) pp. 33–41.
† Tom. cit., pp. 42–44.
‡ Tom. cit., pp. 44–5.
§ Tom. cit., pp. 45–6.
‖ Tom. cit., pp. 46–8.
¶ Tom. cit., p. 59 (1 pl.).
** Tom. cit., pp. 56–8.
†† Tom. cit., pp. 48–50.
‡‡ Tom. cit., pp. 50–5.
§§ Proc. Biol. Soc. Washington, xviii. (1905) pp. 231–2, 239–40.

The same author proposes a new name, *Christensenia*, for the Asiatic genus *Kaulfussia*, since this latter name had been already appropriated twice before for genera belonging to Polygalaceæ and Compositæ. *Kaulfussia aesculifolia* is now to be known as *Christensenia aesculifolia* (Blume) Maxon.

Index Filicum.*—C. Christensen has issued the ninth fascicle of his Index Filicum, carrying forward the alphabetical enumeration of species and synonyms from *Polypodium Beckleri* to *Polystichum aculeatum*. The end being thus nigh at hand, he begs subscribers to call his attention to any omissions or errors which they have observed in the work, that he may be able to insert them in the appendix which will appear in the next part, and which will be followed by the remaining sections of the book—the systematic enumeration of genera and the alphabetical catalogue of literature.

MERRILL, E. D.—**The Flora of the Lamao Forest Reserve.**
[Contains a list of 114 Pteridophytes from this Philippine forest; 17 of the species are endemic.] *Philippine Journ. of Sci.*, i. supp. 1 (Manila, 1906) pp. 13–24.

Bryophyta.

(BY A. GEPP.)

Morphology of Australasian Muscineæ.†—K. Goebel continues his studies of the Archegoniatæ by some detailed observations on the morphology and biology of a number of Australasian Bryophytes, collected by himself some eight years ago. Among the mosses with radial symmetry he discusses *Dawsonia*, *Lyellia*, *Dicnemon*, *Mesotus* and *Leptostomum*, and among the bilateral forms he treats of *Eriopus*, *Pterygophyllum*, *Cyathophorum*, *Mittenia*, *Rhizogonium* and *Orthorrhynchium*. *Dawsonia* is regarded as a primitive member of Polytrichaceæ, being less differentiated in the gametophyte; moreover, in the sporophyte the peristome has always been misunderstood; it has clearly the same origin as that of other mosses, and is of Polytrichaceous character. The distinction between Nematodonteæ and Arthrodonteæ is dropped. The capsule is dorsiventral, and when mature is horizontal. The affinity of *Mesotus* to *Dicnemon* is maintained on the ground of their multicellular spores, and on account of the presence of peculiar protonema-threads or of mucous cells on the leaves. The occurrence of dwarf male plants in these genera has been demonstrated. Turning now to the liverworts, we find detailed investigations of the following: *Gottschea*; hepatics with paraphyllia (e.g. *Marsupidium setulosum*, *Chandonanthus squarrosus*, etc.); marsupiferous Jungermanniaceæ, including the types represented by *Tylimanthus* and *Isotachis*, etc.; *Radula uvifera* with its heterophylly; *Hymenophytum* and the differentiation of its thallus; *Blyttia xiphioides*; *Metzgeria saccata* with its curious water-sacs; *Treubia*, which is not rare in New Zealand; *Moerkia Cockaynii*, a new species; *Marchantia foliacea* with its relatively xerophilous structure; Anthoceroteæ, especially *A. giganteus* (a transition to

* Copenhagen: Hagerup, 1906, pp. 513–76.
† Flora, xcvi. (1906) pp. 1–202 (114 figs.).

Dendroceros), and the water-retaining outgrowths of *A. arachnoideus*. The author points out the frequency of similar structures in parallel groups of the hepatics, citing such instances as leaf-formation, water-sacs, paraphyllia, mucous papillæ, premature spore-germination, etc.

Moss Rhizoids.*—K. Schoene discusses the germination of moss-spores and the biology of moss-rhizoids, with special reference to the rhizoids of the protonema, prefacing his paper with a summary of previous work on the subject. He gives the results he obtained by the culture of spores and protonemata on various nutritive solutions, employing some eight of the commonest species. By the omission of nitrates and phosphate he obtained in both cases a profuse growth of rhizoids of *Funaria hygrometrica*, and no, or very little, chloronema respectively. The other mosses behave quite differently, producing growths that contain no chlorophyll, and correspond with neither rhizoid nor protonema. The author treats also of the form, meaning, and function, of the rhizoids, and of the obliquity of the transverse walls, and of the mechanical advantage they confer upon the plant.

Moss Galls.†—V. Schiffner continues his studies begun last year on moss galls. He has found them occurring on 27 species, including both acrocarpous and pleurocarpous, but never on any species of liverwort. All the instances recorded occur on European specimens. The galls are caused by the attack of a Nematode worm, *Tylenchus Davainii* Bast., and though they are formed on such different species of mosses, they all show the same structure and occur in the same position—namely, at the growing point of a vegetative shoot. They are in the form of bulbous buds, and show, in the cell structure of the enveloping leaves, much similarity with the male buds of the respective species. The galls are almost without exception entirely independent of the inflorescences. As a rule, the growing point is destroyed by the gall, but the author records an instance in which the shoot continued growing through the gall structure ; the species in question was *Dicranum longifolium*. Fungal hyphæ and rotatoria are found in the galls sometimes as well as the Nematodes, but the author regards these as being chance visitors. There is no symbiosis between the moss and the Nematode, nor is it a case of true parasitism, but merely what the author terms "room-parasitism." At the same time there is distinct injury done to the host, which never fruits, but becomes bushy in a manner reminding one of the witches' broom of higher plants.

Abnormal Moss-Capsules.‡—W. Mönkemeyer describes abnormal specimens of *Dicranella varia* and *Bryum saxonicum* Hagen, in which the capsule shows two, sometimes three, lids divided from one another by a hollow cylinder. There is also a multiplication of peristomes, one on the margin of the theca growing upwards in a normal manner, while the other is inserted on the margin of the lid and grows downwards. Many of the teeth of one peristome had united with the teeth of the

* Flora, xcvi. (1906) pp. 276–321 (figs.).
† Hedwigia, xlv. (1906) pp. 159–72.
‡ Tom. cit., pp. 178–81 (2 pls., 6 figs. in text).

other peristome. The plants of *Bryum saxonicum* showed even more complicated conditions than those of *D. varia*; and the details are fully described and figured. In neither species were any spores present in the lid. The author suggests that the phenomena described are due to regeneration arising as the result of mechanical injury to the lid-cells when young. Two instances of cleistocarpy are described and figured for *Bryum saxonicum* and *Pogonatum nanum*.

Subterranean Moss-Flora of France.*—J. Maheu publishes the result of his studies on the flora of caves, wells, and other subterranean localities of France. The work has been an arduous one, and has taken the author more than seven years, while even now he does not suggest that his work is in any degree complete. His object is to study the origin of the flora in question, the modifications which result from the change of environment, morphological variations, and above all the action of different factors on the reproductive organs. The Muscineæ form a large part of the flora of caverns and abysses, and they are treated at some length in the paper, under the headings of: general facts, affinities, geographical distribution, deformations observed on subterranean species, hepaticæ, and general results. In the section describing deformations, the organs are dealt with separately, and figures illustrate the points of interest. The mosses found in caves either do not possess a sporogonium, or if this is present it does not produce spores. Certain species become phosphorescent; but none are ever found in total darkness. In damp and cold caverns which are exposed to the north, the species found are those of a boreal nature, *Hylocomium triquetrum*, *Hypnum Schreberi*, *H. cuspidatum*, etc., i.e. species not found in warmer caves. Details are given as to the conditions which govern the occurrence of certain species, and the whole subject is treated with great thoroughness.

European Sphagna.†—G. Roth has now completed his work on European mosses by bringing out a volume on the *Sphagna*. He had hoped to include also all the foreign species, but as time pressed, he published the European species without further delay. A short account of Sphagnaceæ is followed by the systematic treatment, in which each species is fully described with its varieties, forms, and distribution. Actual keys are not given, but these are replaced by the headings of the groups and by the drawings.

British Muscineæ.—W. H. Painter‡ publishes a joint list of 146 mosses and 53 hepatics collected by himself and by Salter in Cardiganshire during 1903–4; localities and altitudes are given.

M. B. Slater§ gives an account of the mosses and hepatics in the second edition of J. G. Baker's "North Yorkshire," which forms the third volume of the Botanical series of the Transactions of the Yorkshire Naturalists' Union. In his introduction Slater reviews the moss-literature published in this country, especially as concerns the Yorkshire

* Ann. Sci. Nat., sér. 9, iii. (1906) pp. 45–92.
† Die Europäischen Torfmoose. Leipzig: Engelmann, 1906, 80 pp., 11 pls.
‡ Journ. of Bot., xliv. (1906) pp. 166–71.
§ Hull: Brown and Sons, 1906, pp. 417–671.

flora, and then gives an enumeration with localities of all the mosses hitherto recorded for North Yorkshire, following Braithwaite's system of classification. The sphagna and hepatics are treated in similar fashion, Horrell's and Pearson's plans of arrangement being followed respectively.

German Mosses.—A. Geheeb* publishes notes on an arboreal form of *Gymnostomum rupestre*, on a short-leaved form of *Dicranoweisia crispula*, on some rare mosses of the Rhoengebirge, on his projected "Bryologia Atlantica," on the recently deceased moss-expert, Rudolph Ruthe, who collected in Prussia, and devoted himself especially to *Fontinalis* and *Bryum*.

C. Laubinger† publishes some additions to the moss-flora of Niederhessen and Münden, which form the first appendix to a treatise published in 1903. A number of rare mosses have been found in fruit. *Fontinalis dolosa* Cardot is recorded. In a second paper the same author enumerated the mosses in Pfeiffer's herbarium at Cassel.

Mosses of Mark Brandenburg.‡—C. Warnstorf continues his publication on this subject, thereby finishing his account of the Muscineæ of this province, the fruit of some five years' close labour. The present part carries on the work from *Plagiothecium* to the end, and closes with supplements to the first and second volumes. The first volume, published in 1903, contained the Hepaticæ and Sphagnaceæ. The descriptions of the species are long and detailed, and each is followed by an abundance of distributional and biological notes. Elaborate keys to the families, genera, and species are provided, and important characters are illustrated by figures. The author has discarded the old divisions of acrocarpous and pleurocarpous mosses, preferring to follow Fleischer's system which is founded on the structure of the peristome, the main groups being Haplolepideæ and Diplolepideæ; but he retains the Cleistocarpi for practical reasons.

Austrian Mosses.§—J. Glowacki makes additions to the moss-flora of Bosnia, Herzegowina, Dalmatia, and Montenegro, as the result of collections made by himself in those countries. The mosses are grouped together under the name of the locality in which they were found. Some of the species were already recorded, but they are included in the list, thus making it more or less complete; 172 species and varieties are new records for the localities in question, and of these, 2 species and 1 variety are new to science. The nomenclature followed is that of Limpricht in the new edition of Rabenhorst's "Kryptogamenflora," Bd. iv.

Antarctic Mosses.‖—J. Cardot has determined the mosses collected by the 'Charcot' Expedition to the Antarctic in 1898. Three localities have furnished all the specimens—namely, the Islands of Wiencke,

* Rev. Bryolog., xxxiii. (1906) pp. 42–4.
† Abh. Ber. Verein. Nat. Cassel, xlix. (1905) pp. 50–80, 81–102.
‡ Kryptogamenflora d. Mark Brandenburg, Abt. 1 ii. (1906) pp. 833–1160 (figs.)
§ Verh. k.k. Zool. Bot. Gesell. Wien, liv. (1906) pp. 186–207.
‖ Rev. Bryolog, xxxiii. (1906) pp. 33–5.

Wandel and Hovgaard; 13 species are recorded, among them being one novelty, *Brachythecium Turqueti*, and two new varieties. All the plants collected were sterile.

Muscineæ of French Guiana.* — E. G. Paris publishes a list of mosses and hepatics collected in this region in 1905, between Kourou and Remire. The pleurocarpous mosses are, with one exception, species common in the warm and temperate zones of Eastern inter-tropical America; but the interest of the collection lies in the six species of *Calymperes*, all of which are new. Up to the present only five species had been recorded for the three Guianas. Eight hepatics are recorded, of which two are new.

African Mosses.†—E. G. Paris publishes a list of 25 mosses and 12 hepatics collected by Pobeguin in West Tropical Africa in the French Niger Protectorate. Eight of the mosses and two hepatics are new, and have been determined with the help of Brotherus and of Stephani respectively.

Australian Mosses.‡—W. W. Watts and T. Whitelegge continue their catalogue of the frondose mosses of Australia and Tasmania, collated from available publications and herbaria records. The present part, No. II., completes the acrocarpous species. It includes plants from the Melbourne herbarium, and records 918 species, belonging to 44 genera.

North American Mosses.§—E. G. Britton publishes a sixth chapter of notes on nomenclature of mosses, basing her remarks upon Brotherus' work in Parts 222 and 223 of Engler and Prantl's Pflanzenfamilien, and calling attention to the points in which Brotherus has arrived at conclusions similar to those recently arrived at by herself.

A. J. Grout ‖ replies to a criticism by E. G. Britton (in the same journal in September 1904, p. 78) as to the determination as *Plagiothecium Groutii* Card. of a specimen referred to *Raphidostegium recurvans* by other experts. The same author ¶ publishes notes on and descriptions of sundry species, among them being *Tetraplodon australis*, a new form of *Anacamptodon splachnoides*, *Burnettia fabrofolia* (sp.n.), *B. subcapillata*, which has figured under *Homalothecium*, and five other genera.

P. M. Towle ** gives the dates of maturing of the antheridia and archegonia and spores in three species of *Mnium*, together with other facts in their life-history.

Index of Mosses.††—E. G. Paris publishes the final part of the second edition of his alphabetical index of the mosses of the whole world. In it are recognised 14,067 species and 397 genera. A map, tables of distribution, and a concise summary, are appended. In the

* Rev. Bryolog., xxxiii. (1906) pp. 35-8. † Tom. cit., pp. 38-42.
‡ Proc. Linn. Soc. New South Wales, xxx. (1905) pp. 91-163.
§ Bryologist, ix. (1906) pp. 37-40 (1 pl. and figs.).
‖ Tom. cit., p. 42. ¶ Tom. cit., pp. 42-6 (1 pl.).
** Bryologist, ix. (1906) pp. 54-6.
†† Index Bryologicus, ed. 2, Hermann (Paris, 1906) fasc. xxvii. pp. 137-60, tables and map.

tables the number of endemic species of each genus in the several twenty regions are shown, as well as the more or less pandemic species; and the inter-relationships of the regions are discussed in the summary.

Jungermannia barbata and its Allies.* — H. W. Arnell, when searching among the Barbatæ group of *Jungermannia* in his own herbarium with a view to discovering, if possible, Swedish specimens of *J. Baueriana*, a new species established by Schiffner, and recently recorded for Finland and Norway, found that he possessed several examples of the plant from four provinces of Sweden. It occurs in rather dry shady places on silicious rocks. It is a good species, but variable, and absorbs many outstanding forms of *J. lycopodioides*, *J. Floerkei*, and *J. barbata*. The true differences between *J. Baueriana* and these latter species are pointed out by the author, who has been forced to the conclusion that *J. Baueriana* represents the primitive species of the whole group. This assumption he illustrates with a pedigree table, wherein the first descendants of *J. Baueriana* are *J. lycopodioides*, *J. Floerkei*, and *J. barbata*. *J. barbata* remains without issue; but from *J. lycopodioides* proceed in direct descent *J. quinquedentata*, *J. exsecta*, and *J. exsectæformis*; while from *J. Floerkei* spring two lines, one constituted by *J. atlantica*, *J. gracilis*, *J. Binsteadii*, *J. herjedalica* and *J. polita*, and the other by *J. quadriloba*, *J. Kunzeana* and *J. obtusa*. His reasons for this assumption are stated, and critical notes on each of the species are given.

Hepatics of the Jura.†—Ch. Meylan issues a supplement to his catalogue of the hepatics of the Jura, which was published five years ago. The number of species is now raised from 87 to 115, most of the additions being species which shun the limestone, and which were found on humus, or in bogs, or on silicious soil, the flora of the calcareous soil being restricted or monotonous. The very rare *Haplomitrium Hookeri* may be more common than is supposed, but is excessively difficult to detect in the sterile state.

North American Hepatics.‡—E. Claasen publishes a revised key to the species of liverworts recognised in the sixth edition of "Gray's Manual of Botany." It is a continuation, or rather, amplification, of the key published last year in the same journal. The genera are arranged alphabetically, and the characters, by which the species under them are discriminated, are more detailed than is usual in a key with the purpose of rendering determination more easy and more precise.

Brotherus, V. F.—**Engler und Prantl's Die Näturlichen Pflanzenfamilien. Musci.** (Engler and Prantl's Natural Families of Plants. Mosses.)
[Continuation. Spiridentaceæ, Lepyrodontaceæ, Pleurophascaceæ, Neckeraceæ.] Leipzig: Engelmann, 1906, lief 224, pp. 769-816 (33 figs.).

Gepp, A.—**The Dates of Hooker's "British Jungermanniæ" and "Musci Exotici."**
[Affords means for determining the date of publication of any species or plate in these works.] *Journ. of Bot.*, xliv. (1906) pp. 176-8.

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* Bot. Notiser, 1906, pp. 145-57.
† Bull. Herb. Boissier, vi. (1906) pp. 489-503 (fig.).
‡ Ohio Naturalist, vi. (1906) pp. 530-40.

HERZOG, T.—**Die Laubmoose Badens.** (The moss-flora of Baden.)
[Continuation.] *Bull. Herb. Boissier*, vi. (1906) pp. 409–24.

MERRILL, E. D.—**The Flora of the Lamao Forest Reserve.**
[Contains a list of 23 mosses and 11 hepatics from this Philippine forest; three of the mosses are endemic.]
Philippine Journ. Sci., i. supp. 1 (Manila, 1906) pp. 10–13.

MÖNKEMEYER, W.—**Bryologische Wanderungen in der Rhön im Juli 1905.** (Bryological wanderings in the Rhöngebirge.)
[The author alludes to Geheeb's description of the moss-flora of Milseburg, in which 222 species are recorded. In the present paper 12 species are added to the flora, and the habitats of other species are described. Thirty-five hepaticæ are also recorded for that region.]
Hedwigia, xlv. (1906) pp. 182–9.

STEPHANI, F.—**Species Hepaticarum.**
[Continuation, containing descriptions of *Leioscyphus* (5 species), *Southbya* (3 sp.), *Arnellia* (1 sp.), *Gongylanthus* (11 sp.), *Clasmatocolea* (6 sp.)]
Bull. Herb. Boissier, vi. (1906) pp. 377–92.

WATTS, W. W.—**Australian Mosses. Some Locality Pictures.**
[Continuation.] *Bryologist*, ix. (1906) p. 41.

Thallophyta.

Algæ.

(By E. S. GEPP.)

Colouring Matter in the Chromatophores of Diatoms.*—F. G. Kohl continues his studies on this subject, and in the present paper he states definitely that the pigment of diatom chromatophores consists of (1) chlorophyll, with the same spectrum of absorption as that of the higher plants; (2) carotin; (3) xanthophyll. The author criticises the work of Molisch on the subject, and considers the presence of leucocyanin in diatoms is merely hypothetical. No such substance as diatomin exists at all in plants. There is no reason to consider the colouring of the chromatophores of diatoms, as differing from that of the chromatophores of the leaves of Phanerogams. Reasons for his conclusions are given by the author, with details of his experiments. The paper closes with a reply to the criticisms of M. Tswett.

Pleomorphism of Melosira.†—O. Müller discusses the pleomorphism, auxospores, and resting spores of *Melosira*. Beginning with a short account of collections sent to him from Iceland by C. H. Ostenfeld, and from Zürich and Neu-Ruppin by other savants, he sums up the observations of previous authors on the pleomorphism of *Melosira* and sundry other genera, modifying some of his own former conclusions. He describes a new species, *M. islandica*, with its varying forms, auxospores and their germination; and the same for the new sub-species, *M. helvetica*, and for *M. italica* Kuetz. The latter is the first fresh-water species in which resting spores have been found, these having previously been recorded as *M. lævis*, a species which must now be cancelled. A new sub-species of *M. italica* is described in all its forms; it is called *M. subarctica*. The development of the auxospores has been carefully

* Ber. Deutsch. Bot. Gesell., xxiv. (1906) pp. 124–34.
† Pringsheim's Jahrb. wiss. Bot., xliii. (1906) pp. 49-88 (2 pls. and figs.).

studied in five species, and their characters are summed up in a synoptical form. The author gives a list of other species which require further investigation. Finally the author states that although the chains of *Melosira islandica* and of *M. italica* exhibit a pleomorphism of the individuals, yet after the formation of auxospores the species reverts to its normal form. The purport of the pleomorphism is not yet understood.

New Coralline Algæ.—M. Foslie * describes some new species and varieties of *Lithothamnion* and *Lithophyllum*, mostly from the Antarctic region, collected by the 'Gauss,' the 'Discovery,' the 'Antarctic' and the 'Scotia.' Species from Port Phillip and the West Indies are added.

Another paper † gives further descriptions of new species and of a new genus, *Litholepis*, which is intermediate between *Melobesia* and *Mastophora*. *Litholepis* contains three species, *L.* (*Melobesia*) *caspica* and *L.* (*Melobesia*) *bermudensis* already described, and a new species, *L. Sauvageaui*. Notes follow on *Goniolithon*, *Heteroderma*, and *Dermatolithon*.

A number of dead nodules of *Lithothamnion* were brought up by excavators in the harbour of Vardö in East Finmark, and these are described by the same author ‡ as a new species, *L. Vardöense*, approaching in habit *L. norvegicum* f. *nodulosa*. Living specimens of *Lithothamnion* are no longer found in the harbour.

Seven new species and three varieties from the West Indies are described and figured by M. Foslie and M. A. Howe.§ Some of these are sterile, but the plants possess well marked distinctive characters in outward form or internal structure.

Finally, in a short paper eighteen new species and some varieties are described by M. Foslie ‖ from various parts of the world.

Remarks on Northern Lithothamnia.¶—M. Foslie publishes a detailed account of the Norwegian species of Lithothamnioneæ and Melobesieæ. The paper opens with some interesting observations on the group, in which the author gives his reasons for the reduction of species and the formation of new forms. He considers that Lithothamnia are largely influenced by outside conditions, and that plants which have been made types of new species are in reality but peculiar forms of existing species. There are three principal agents which militate against normal development in this group: (1) larger crustacea and boring mussels which break and otherwise damage the plants; (2) boring algæ, especially *Ostreobium Queketti* Born. and Flah.; (3) friction from strong currents, reducing branched plants to compressed globular masses. Lithothamnia flourish best where there is a firm bottom and the tidal action is fairly strong, without being excessive. Full descriptions are given of species and forms, with their respective synonymy, followed by copious critical notes.

* Kgl. Norsk. Vidensk. Selsk. Aarsb., 1904, 4 pp.
† Op. cit., Skrift, 1905, No. 5, 9 pp. ‡ Tom. cit., No. 2, 4 pp.
§ Bull. New York Bot. Gard., iv. (1906) pp. 128–36 (14 pls.).
‖ Kgl. Norsk. Vidensk. Selsk. Aarsb., 1905, 8 pp.
¶ Op. cit., Skrift, 1905, No. 3, 138 pp.

New Squamariacea.* — M. Foslie describes a new species which he refers with certain doubt to *Peyssonnelia*, under the name of *P.* (?) *compacta*. It forms part of Heydrich's *Sporolithon mediterraneum*, and may also be identical with the same author's *Polystrata dura* from the Island of Tami. It approaches very nearly to *Peyssonnelia polymorpha* (Zan.), and may perhaps be a variety of that species; but to decide this point on sterile material is impossible, and the fruit of *P. compacta* is still unknown. *P. compacta* has a crust-like thallus, up to 5 mm. thick, very closely and firmly adherent to the substratum, though the author has seen no rhizoids. It is very hard and stony, being encrusted with carbonate of lime. In structure it approaches both *Polystrata dura* and *Peyssonnelia polymorpha*, though the cells are a little larger than in the former and a little smaller than in the latter. The plant occurs in the Adriatic and Mediterranean.

Cladostephus verticillatus.†—C. Sauvageau publishes the first part of a detailed account of this plant, in which he treats of the structure, growth, and ramification of the erect shoots ("pousses indéfinies"); a further paper will deal with the branches, or "pousses définies." The branching is never dichotomous, as has been supposed by some authors. An erect stem, arising from a creeping thallus, produces at irregular intervals similar shoots to itself, and these all bear branches arranged verticillately. The ramification, taken as a whole, shows so much variety that the author proposes to constitute a special group for *Cladostephus* within Sphacelariaceæ, under the name of Polyblastæ, parallel to Hemiblastæ and Holoblastæ. The indefinite shoots ("pousses indéfinies") are plagioblastic; the verticillate branches are hemiblastic, or meriblastic; the branchlets of these are holoblastic; and the fruit-bearing shoots are microblastic.

Distribution of Marine Algæ.‡ — N. Svedelius has made some interesting observations on the likeness that exists between the marine vegetation of the West Indies, the Indian and the Pacific Oceans. He deals with the work of other authors on this subject, and is himself of opinion that the reason for the similarity in the three floras is to be sought in the historical development of the distribution of land and water on the borders of North and South America, where it is seen that the Caribbean Sea is merely a creek, so to speak, of the Pacific Ocean, or a strait connecting the two great oceans of the world.

Nomenclature of Desmids, and other Algological Notes.§ — O. Nordstedt proposes that 1848 should be the starting point from which to reckon the nomenclature of Desmids, and his reasons for this are shown by an historical review of the work done on the group since 1810. He lays down the following rules: (1) The nomenclature begins with the "British Desmidiaceæ," by Ralfs, in 1848. (2) The authors of names given earlier, but accepted by Ralfs in "British Desmidiaceæ," must always be quoted as such, unless the identification of the name in

* Kgl. Norsk. Vidensk. Selsk., Skrift, 1905, No. 1, 9 pp. (fig. in text).
† Act. Soc. Linn. Bordeaux, lxi. (1906) 26 pp. (figs in text).
‡ Bot. Notiser, 1906, pp. 49–57. § Tom. cit., pp. 97–124.

Ralfs's "British Desmidiaceæ" and in the works of the older authors be very doubtful. (3) The following earlier specific names have priority, and must be retained: *Closterium Libellula* Focke (if removed from *Penium*) and *Desmidium cylindricum* Grev. (*Didymoprium* Ralfs, 1845). Three other short notes are entitled "Aphanochæte or Herposteiron," "Tribonema or Conferva," and "Myxonema or Stigeoclonium." The paper is in English.

Sphæroplea annulina.*—K. Meyer has made a study of the development of this alga, especially as regards the germination of the oospore, the formation of the zoospores, the spermatozoids, and the egg-cells; he has also studied the systematic position of the species. The author gives a detailed description of the development of the antheridia and oogonia, and then proceeds to the oospore and its germination. This may take place according to one of two different types, and both are described; the number of zoospores is always four, and not, as other authors have suggested, a varying number. As regards the systematic study of *S. annulina*, the author finds that the recognised varieties (formerly regarded as species) are so uncertainly defined, and the species itself is so variable, that he considers there is only one species of *Sphæroplea*, *S. annulina*, with two extreme forms, *Braunii* and *crassisepta*, and a series of intermediate forms between.

Subterranean Algal Flora of France.†—J. Maheu has made a study of the entire flora of the caves, wells, and other subterranean localities of France. The environment is not conducive to the development of algæ, those most commonly represented being species of *Hæmatococcus*, *Protococcus*, Palmellaceæ, and Diatoms. The species are poor in chlorophyll, reduced in size, and sometimes so polymorphous as almost to constitute new forms. The author notes that the colour of certain species varies from green to red, according to the degree of darkness in which they live, and while some genera cannot live without a certain amount of light, others are able to develop in total obscurity. This paper includes some interesting observations on the occurrence of bacteria in subterranean streams, and the influence on public health that these are able to exercise throughout a large area.

Protococcoideæ.‡—C. E. Bessey continues his work on the structure and classification of algæ, and in the present paper he deals with the Protococcoideæ, prefaced by a key to the four orders of Chlorophyceæ. Keys are given to the families and genera of Protococcoideæ, and the relationships of the genera in each family are indicated by diagrams. Each genus is described, and measurements of the cells are given. Other classifications of the green alga are discussed and compared in tabular form, notably those of Engler, Blackman and Tansley, West, and Oltmanns. Then follow remarks on the relationship of the green algæ to the lower animals, and a chart to show the mutual relationships of the genera of Protococcoideæ.

* Bull. Soc. Imp. Nat. Moscow, xix. (1906) pp. 60–84 (2 tables).
† Ann. Sci. Nat., sér. 9, iii. (1906) pp. 93–8.
‡ Trans. Amer. Micr. Soc., xxvi. (1905) pp. 121–36 (1 chart).

Plankton of some Irish Lakes.*—W. and G. S. West continue the account begun in 1902 of the plankton collected by them from Irish lakes. The previous paper treated of Lough Neagh and Lough Beg, while the present one deals with plankton from the most important lakes in the west and south-west of Ireland. The flora of these lakes is compared with that previously recorded from Lough Neagh and Lough Beg. Some of the pelagic organisms had never before been observed in the British Isles. The authors divide their subject into two parts, one being a detailed account of the plankton of the loughs investigated, and the other a systematic account of the more important algæ of the plankton. In the first part, sixteen of the loughs are described shortly, and mention is made of any peculiarities exhibited by the plankton, with the dominant forms contained therein. Special note is taken of the forms of *Ceratium hirundinella* O. F. Müll., the abundance and variation of which is a striking feature of the fresh-water plankton of Great Britain and Ireland. The diversity of form is greater in Ireland than in the west of Scotland, or in the Orkneys and Shetlands; indeed, it is not uncommon to have two or even three distinct forms in one lake. Figures are given of nine different forms. The second part of the paper deals specifically with those algæ of the plankton deserving of special mention, either for their abundance or rarity, or for some peculiarity which had hitherto escaped observation. Five new species are described, and three new varieties. Four quarto plates show photomicrographs of plankton, and two show figures of algæ.

CORI, C. J.—**Ueber die Meeresverschleimung im Golf von Triest im Sommer 1905.** (On the sliminess of the sea in the Gulf of Triest in the summer of 1905.)
Arch. Hydrobiol. u. Planktonk., i. (1906) No. 3.

KYLIN, H.—**Biologiska iakttagelser rörande algfloran vid Svenska Västkusten.** (Biological observations on the algal flora of the west coast of Sweden.)
Botan. Notiser, (1906) pp. 125–37.

MACOVEI, G., ET J. SCRIBAN—**Contributions à l'étude de la flore des lacs d'eau douce de la Dobrogea.** (Contributions to the study of the flora of the fresh-water lakes of the Dobrogea.) *Ann. Sci. Univ. Jassy*, iii. (1906) pp. 239–43.

MIGULA, W.—**Thomé's Flora von Deutschland. V. Kryptogamen.** (Flora of Germany. Cryptogams.)
[Diatomaceæ continued. *Navicula—Mesotænium.*]
Gera: Zezschwitz, 1906, lief 27–9, pp. 257–352 (15 pls.)

STADLER, E.—**Ein kleiner Beitrag zur Kenntniss der Süsswasseralgen von Dalmatien.** (A small contribution to a knowledge of the fresh-water algæ of Dalmatia.)
[The results of an examination of algal material, collected by Beck v. Mannagetta in several places in Dalmatia. The author includes all known records from that country.]
SB. Nat. Wiss. Med. Ver. "Lotos," Prag., xxv. (1905) pp. 236–44.

TANNER, FULLEMANN—**Sur un nouvel organisme du Planeton du Schœnenbodensee.** (On a new plankton organism of the Schonenbodensee.)
[*Rophidium Chodati* Tanner.]
Bull. Herb. Boissier, vi. (1906) pp. 156–8 (figs.)

ZACHARIAS, O.—**Das Plankton als Gegenstand eines zeitgemässen biologischen Schulunterrichts.** (Plankton as a subject for modern biological instruction in schools.) *Arch. Hydrobiol. u. Planktonk.*, i. (1906) 98 pp., 17 figs.

* Trans. Roy. Irish Acad., xxxiii. (1906) pp. 77-116 (6 pls.).

Fungi.

(By A. Lorrain Smith, F.L.S.)

Study of Mucorini.*—A. F. Blakeslee continues his researches on the Mucorini, and his recent paper deals with the germination of the zygospore. His aim was to find at what stage the sexual character of the thallus was determined. In a species like *Sporodinia grandis*, which is homothallic, the germination of the zygospores is also homothallic. In *Mucor Mucedo*, which is heterothallic, all the spores in a given sporangium produced from one zygospore are of the same strain, either (+) or (−), so that segregation of sex is completed before the sporangium is formed. In another heterothallic form, *Phycomyces*, the differentiation of the spores in any sporangium is only partial. In addition to (+) and (−) heterothallic spores, other spores are formed in this species which produce homothallic mycelia. The latter has a peculiarly velvety appearance owing to the presence of coiled and contorted outgrowths, which the writer terms pseudophores; sporangia are rarely formed, and only on the comparatively stout and less coiled outgrowths. Zygospores are also occasionally formed on the same mycelium; usually they are only partially developed. It has not yet been determined if this homothallic nature is fixed. If the mycelium is transplanted from this homothallic strain the character is retained, but spores from the sporangia are again either (+) or (−). In nature the homothallic mycelium is probably rare, and disappears in the course of a few sporangial generations.

Development of Thelebolus stercoreus.†—Gustav Ramlow has worked out this minute Ascomycete. He gives first of all an account of the researches and results of other workers on the same plant, and then describes the methods he employed and the stains he used. The most successful cultures were on agar with dung decoction. The first beginnings of fruit formation show coiled hyphæ like a screw which grows up from the vegetative mycelium. Septa only appear in the coil when the ascogonium has reached a considerable size and the enveloping hyphæ have begun to grow round it. These last arise from the stalk hypha near the ascogonium. No communication is ever seen between the ascogonium and any other hypha; no fusion of cells takes place. One of the ascogonium cells grows more vigorously than the others, and the neighbouring cells also increase to a less extent. The cell that has thus grown to so great a size is the young ascus. When more than one ascus appears in the mature fructification there is, as Brefeld showed, really a compound fruit formed, the result of two (or more) ascogonia which have developed in close proximity. The development of the large ascus is aided by the nutritive material stored in the neighbouring cells which are rich in contents.

The cytology of *Thelebolus* was also carefully worked out by the author. Each vegetative cell is uninucleate: further details of these nuclei were not noted. Before the septa are formed in the young

* Ann. Mycol., iv. (1906) pp. 1–28 (1 pl.).
† Bot. Zeit., lxiv. (1906) pp. 85–99 (1 pl.).

ascogonium two nuclei are visible, which increase to four and eight. After septation, one cell retains two nuclei—the large ascus cell. These two nuclei fuse together as in other asci; they are probably cousin-nuclei of the second degree. Then the fused nucleus multiplies by division to some 1026. They are so minute that it was impossible to see details, but spindle and diaster were plainly visible, showing the normal mitotic division.

In spore formation it was noted that there was no previous splitting or division of the plasma as in the Phycomycetes; the nucleus lay at the apex of the newly formed spore as in other Ascomycetous spores, and between the spores there were remains of the epiplasma; the spores are therefore the result of free-cell formation.

The author insists on the Ascomycetous character of the fungus. It differs from *Rhyparobius* so far that each ascus is the product of a separate ascogonium, but it stands in the same relation to *Rhyparobius* as *Sphærotheca* does to *Erysiphe*. Also the development is apogamous. As in some other Ascomycetes, sexuality has disappeared.

Germination of Truffle Spores.*—Em. Boulanger watched the germination of the spores take place in the ascus itself. The brown exospore bursts, generally towards the equator, and becomes destroyed. The spore then puts out a germinating tube.

Submerged Fungus.†—H. Rehm describes a Discomycete that he found growing on branches under water. It has been classed by him in the genus *Psilopezia*, rather than in *Humaria* or *Peltidium* in which it had been placed. The fungus has no marginal wall.

Yeasts.‡—A. Osterwalder has carried out a systematic examination of fruit and vine yeasts. He examined them microscopically, noting the size and form of the cells, and made cultures of the different species, both streak cultures and giant colonies. He isolated eight different species, and the results of the cultures, fermentations, etc., are recorded in a series of tables.

Th. Bokorny § has examined the behaviour of various yeasts with regard to colouring matters and metal salts. Yeast cells attracted and stored silver nitrate in extremely weak solutions. Similar results were obtained with copper salts. The quantity of poison required to kill the cells by acting on the protoplasm has not been determined. With colouring materials, he found that a minute percentage of methyl-violet coloured the cells without injuring them; a larger quantity coloured them more quickly but finally killed them.

In another paper ‖ Bokorny gives the results of further work on the growth of yeasts in solutions containing mineral substances, his aim being to determine the nature of the influence exerted by the poison on the

* C. R. Soc. Biol. Paris, lx. (1906) pp. 42–3 (2 pls.) See also Bot. Centralbl., ci. (1906) pp. 416.

† Mitth. Bayer. Bot. Gesell., (1905) No. 34, p. 423. See also Bot. Centralbl., ci. (1906) pp. 450–1.

‡ Centralbl. Bakt., xvi. (1906) pp. 36–52 (1 pl.).

§ A. Br. H. Zeit., Aug. 1905. See also Centralbl. Bakt., xvi. (1906) pp. 257–8.

‖ Wellend. Zeitschr. Spir. Ind., Juli 1905. See also Centralbl. Bakt., xvi. (1906) pp. 239–40.

cell contents. If a trace of yeast cells from a culture is placed in distilled water with a definite mixture of mineral and sugar solution, the mineral is taken up by the protoplasm of the cell and death follows; but if a large quantity of yeast is placed in the same mixture no harm is done.

Heinrich Zikes* describes a new species of "anomalous" yeast, *Willia Wichmanni*. It has the peculiar cap form of the other members of this group. The author describes the characters of the group, and then gives the history of the new species which was isolated from the soil in the neighbourhood of Vienna.

Nuclear Division in Yeast.†—Franz Fuhrman has made a cytological study of *Saccharomyces ellipsoideus* I. Hansen. He compares his results with those recently published by Schwellengrebel, and finds that though they agree in the main there are some small differences to be noted. He finds that division results in two equal daughter-nuclei; Schwellenberg had noted a difference in size and that the smaller nucleus migrated to the newly formed cell. He sums up the phases of karyokinesis thus :—

1. Formation of knot stage, increase of chromatic substance, and disappearance of nuclear membrane.
2. Formation of apparently four chromosomes.
3. Arrangement of chromosomes in monaster, and formation of achromatic spindle (perhaps with centrosomes).
4. Division of chromosomes into daughter-chromosomes.
5. Formation of diasters.
6. Polar deposition of chromosomes, resembling the knot stage.
7. Return of each daughter-nucleus to the resting condition.

The writer never detected any case of nuclear fusion in his preparations. As to the budding stage, in general, it begins at a later period than nuclear division. In most cases it began with the monaster stage, but it sometimes took place earlier. He found it very rarely occurring at the same time as the diaster stage. Migration of the nucleus occurred most frequently at the knot stage, after which a resting period ensued.

Symbiotic Yeast.‡—L. Lutz published in the Bull. Soc. Mycol. France, 1899, p. 68, an account of "Tibi," a symbiotic growth of a yeast and bacillus that is used in Mexico, along with sugar, to form a fermented liquor. The yeast is named *Saccharomyces Radaisii*, the bacillus is *B. mexicanus*. His object has been to attempt the association with other bacilli, but he was only successful with *B. subtilis*. The two organisms formed the small creamy balls which produced the fermentation. The association in the case of other bacilli was not stable, and one symbiont gradually displaced the other. The function of the bacilli is to form an anaerobic environment for the yeast.

A New Lichen Parasite.§—A. Zahlbrückner found that the fruit of the lichen *Caloplaca callopisma* was deformed by the presence of a fungus which grows on the hymenium. From the hyphæ of the fungus

* Centralbl. Bakt., xvi. (1906) pp. 97–111.
† Op. cit., xv. (1906) pp. 769–77 (1 pl.).
‡ Bull. Soc. Mycol. France, xxii. (1906) pp. 96-8.
§ Ber. Deutsch. Bot. Gesell., xxiv. (1906) pp. 141–6 (1 pl.).

there arise vertical branches; these fork, and at the top of each fork a two-celled spore is borne. Zahlbrückner names the fungus *Lindauopsis Caloplacæ* g. et sp. n., a Hyphomycete near the genus *Didymaria* in the Mucedinaceæ-Hyalodidymæ group.

Uredineæ.—Otto Schneider* has made a prolonged study of *Melampsora*, the rust of willows. He records the results of 38 different series of infection experiments, and has, in the course of his work, established several new form-species. He finds a general morphological resemblance between the different willow *Melampsoræ*, though biologically they are widely different.

Another series of experiments on rusts has been carried out by Fr. Bubak,† extending over two years. He has proved that *Uromyces Poæ* forms an *Æcidium* on *Ranunculus auricomus*. He considers that *U. Poæ* may represent six or eight biological species. *Uromyces graminis* on *Melica ciliata* has its *Æcidium* on *Seseli glaucum*. The other experiments served to confirm results already obtained, or they were without success.

Rusts of Australia.‡—D. McAlpine has published a book which contains a record of all the rusts of Australia so far as they are known at present. The first part of the work deals with the general aspect of the subject, describing the fungi with their vegetative and reproductive phenomena, and the different kinds of spores, with their probable origin and development. The indigenous species are distinguished from those that have been introduced; they are mostly autœcious, and complete their life history on one host-plant. Only four native species, so far, have been found to be heterœcious. The author discusses the question as to the method of infection and the spread of rust, and he also advises as to the means of combating the disease.

The second part of the book, from chapter xx. onwards, deals with the classification of the fungi in the order Uredineæ. The technical terms are explained, and diagnoses are published of all the species, native or introduced.

Infection Phenomena in Uredineæ.§—I. B. Pole Evans describes the process of inoculation and infection by uredospores. The inoculation stage includes the entrance of the germ-tube into the stoma, and the swelling up of the tip to form the substomatal vesicle. Infection has taken place when filaments grow out from the vesicle and form haustoria in the cells of the host-plant. The substomatal vesicle varies in form with the different species.

Disease of Bamboo.‖—S. Hori describes a smut of bamboo caused by *Ustilago Shiriana* P. Henn. It is produced on the growing points and internodes of the young branches, causing often deformation or distortion. The author recommends that the smutted branches should

* Centralbl. Bakt., xvi. (1906) pp. 74–93 and 159–76.
† Tom. cit., pp. 150–9.
‡ Melbourne: R. S. Brain, 1906, vi. and 349 pp., 44 pls.
§ Trans. Brit. Assoc., 1905, pp. 595–6.
‖ Bull. Imp. Agric. Exp. Station, i. (1905) pp. 73–89 (4 pls.).

be burnt while still covered by the leaf-sheath, and before the spores are exposed and scattered. The disease is widespread in the bamboo forests of Japan, and causes much loss to the growers.

Affinities of the Fungus of Lolium temulentum.*—E. M. Freeman calls attention to the discovery of the method of smut infection of wheat made by Frank Maddox, Tasmania, in 1895, and re-discovered lately by Hecke and Brefeld. The infection takes place by means of the stigma, and the fungus becomes imbedded in the seed, developing with the embryo the following year. Freeman compares the fungus found in the seed of *Lolium temulentum* with smut, and finds that the two plants are very similar. He considers that in the case of *Lolium* it is undoubtedly a smut that has gained entrance to the seed. The spores of the fungus have never been found, but he cites instances of smut infection where no spore formation took place.

Tree-Root Rot.†—An account is published of *Agaricus melleus*, a widely distributed and very common British "toadstool." It grows on the roots of living trees as well as on dead stumps, and causes much damage. Advice is given as to the measures to be taken to stamp out the disease, and a warning is added against wounding the base of the trunk or the roots of trees, as the fungus can only enter through a wound.

Spores of Lycoperdon.‡—Ch. Van Bambeke has examined the spores in this genus to determine to what extent the condition of the mature epispore is of assistance in the classification of species, which have been divided by systematists into smooth-spored and rough-spored groups. The author finds that in many species the smoothness or roughness of the spore depends on the medium in which it is examined, and on the degree of magnification. He is of opinion that none of the spores are quite smooth, but he would retain this character as an aid to determination, making two groups, one of which would contain all spores distinctly echinulate, the *asterosporæ*, while the other, the *subasterosporæ*, would designate those with an almost smooth epispore.

Influence of Parasites on the Biology of the Host Plant.§—L. Montemartini finds that in some cases the fungal parasite accelerates, in others it hinders, the life processes. Leaves attacked by Uredineæ show increased assimilation. Transpiration is generally stronger in infected than in sound leaves. Many parasites have no direct regular and constant influence on the absorption of water and salts. That depends rather on the conditions of transpiration and assimilation. Any excitation is really due to the toxin introduced into the plant by the parasite.

Subterranean Fungi.‖—As fungi grow abundantly in the dark and in humid conditions, a large flora was to be expected in the caverns

* Ann. Mycol., iv. (1906) pp. 32–4.
† Journ. Board Agric., xiii. (1909) pp. 111–14 (1 fig.).
‡ Bull. Soc. Mycol. France, xxii. (1906) pp. 23–8.
§ Atti Ist. Bot. Pavia, ix. (1905) 59 pp. See also Centralbl. Bakt., xiv. (1906) p. 246.
‖ Ann. Sci. Nat., sér. 9, iii. (1906) pp. 102–67.

explored botanically by Jacques Maheu. The low temperature, however, is against them, and the soil is not always favourable. There are three classes of such fungi: (1) those that have been carried into the caves accidentally on detritus, pieces of wood, etc.; (2) those that are developed from spores and show peculiarities of form; and (3) those that are completely acclimatised and transmit their acquired characters to their descendants. Monstrosities of form are continually met with, especially among the Hymenomycetes.

The flora of the different caverns corresponds always with that occurring on the surface of the soil. The Ascomycetes are few and abnormal, often sterile, or only in conidial form. An *Isaria* and a *Laboulbenia* were observed on insects. The pore-forming fungi are the most numerous among the Basidiomycetes, and they are almost always deformed or sterile. The author thinks that probably they arise from mycelium or spores coming from the exterior, and that they die out in a few generations. He sums up the deformations thus: lengthening of the stalk, disappearance of colour, reduction and polymorphism of the pileus, variation in the formation of the hymenium, loss of the power to form spores, disappearance of the sporiferous hyphæ, and production of conidia. It is not only the darkness, he adds, that causes these abnormalities, but the whole of the conditions of cavern life.

French Mycological Notes.—An account is given by M. Corfec* of a mycological excursion in the neighbourhood of Laval (Mayenne). He describes the kind of territory that was explored, and gives lists of the species of fungi collected.

M. Baret† is employed to verify the fungi exposed for sale in the market-place at Nantes. He gives a list of the species used for food, and notes those that were abundant or the reverse during the season. He gives a list of 26 species that were considered edible.

R. Maire‡ reports on the various excursions taken by the French Mycological Society in 1905. The members met in Lorraine, and the specimens collected were exhibited at Nancy. An account of the routes taken is given for each day, and a list of the fungi collected in the various localities visited.

Mycological Notes.—C. G. Lloyd§ publishes three double photographic plates of various specimens of *Bovistella*, *Lycoperdon*, *Calvatia*, *Arachnion*, and *Holocotylon*, with notes on the species illustrated. He gives special descriptions of *Arachnion*, a specimen of which has recently been sent to him from Italy, the first record for Europe. He also gives a diagnosis of *Holocotylon* and the species *H. Texense*. Both these genera are distinguished by a chambered gleba, and by the absence of capillitium.

W. W. Stockborger‖ remarks on the somewhat frequent occurrence of *Anthurus borealis* in Ohio. He gives a note of the various places where the fungus has been collected.

* Bull. Soc. Mycol. France, xxii. (1906) pp. 29-31.
† Tom. cit., pp. 32-3.
‡ Tom. cit., pp. i.-xxxix.
§ Mycol. Notes Cincinnati, 1906, pp. 245-60 (3 pls. and 10 figs.).
‖ Ohio Nat., vi. (1906) p. 517.

British Mycology.*—The Transactions of the British Mycological Society contain an account of the autumnal meeting at Haslemere. 488 species of fungi were collected or identified during the foray. A list of these is published.

The presidential address by R. H. Biffen dealt with the combating of fungoid diseases of plants. The author gives some data as to the havoc wrought by disease in plants, and groups his subject under three headings: (1) avoiding the conditions known to be favourable for the spreading of the disease; (2) destruction of plant tissues containing the resting forms of the fungus; (3) exterminating the parasite without injuring the host. Under the latter heading he describes the hot-water method of killing smutted grain, the cases where fungicides are likely to be useful, and, finally, he draws attention to the advantage of selecting races and varieties immune to disease.

A. Lorrain Smith contributes a note on *Sphæropsis Pinastri*. The descriptions and synonymy of the species have been considerably confused.

J. F. Rayner recommends mycology as a branch of nature study, pointing out the advantages to teacher and pupil in including this group of Cryptogams in the list of nature subjects.

The list of "Fungi New to Britain" is, as in previous years, supplied by A. Lorrain Smith and Carleton Rea. The novelties this year are mostly among the larger fungi.

Ancestors of the Higher Fungi.†—P. A. Dangeard continues at great length his studies on the development of fungi. In a preliminary chapter he discusses the various theories as to their origin. He does not hold with those who derive them from algæ—he traces their origin to the Amœbæ through the Flagellatæ—and he considers that the two great factors in securing evolution were teleomitosis, with its exact division of chromosomes, and the introduction of sexuality. In succeeding chapters he develops his theories in tracing the detailed history of some special forms. *Rhabdium Hedenii*, a new genus of Chytridineæ described by himself, had been placed by Atkinson in *Harpochytrium*. Dangeard insists on the correctness of his own views, and he gives a full account of the life-history of the fungus. It is one of the lower forms very near the Flagellatæ, and probably without any sexuality. He finds a higher type in *Myzocytium vermicolum*, a parasite of Nematodes, which possesses both sporangia and gametangia. At the time of fecundation there is only one nucleus visible in the oogonium, the nucleus from the antheridium passes in, and fusion takes place. The oospore has one large nucleus. The author considers this a sort of prototype of the Peronosporeæ; there is no appreciable periplasm left in the oogonium, and the nuclei are reduced in number. *Ancylistes Closterii* is described and compared with other forms. The number of chromosomes in the dividing nucleus is two. The nuclei of the antheridium number six; there are many more in the oogonium; no fusion of the nuclei was observed, and the maturing oospore contains a number of nuclei, both

* Trans. Brit. Mycol. Soc., 1905 (Worcester, 1906) pp. 101-31 (4 pls.).
† Le Botaniste, sér. 9, fasc. 3-6 (1906) pp. 159-303 (18 pls.).

male and female. This persistence of both kinds of nuclei seems to be peculiar to *Ancylistes*. Succeeding chapters are devoted to a consideration of zygospore formation in the Mucorini, to the Hemiasci, more particularly *Protascus* and *Protomyces*, and to a general discussion on the development of sexuality in the lower fungi, the writer insisting that it was an autonomous development within the group.

Fungi parasitic upon Scale-Insects.* — John Parkin publishes a general historical account of these economically useful fungi, and then turns to the Ceylon forms which he has studied for some years. He takes the various fungi in systematic order, referring briefly to those that occur elsewhere, and describing carefully the forms met with on the island. All these scale fungi, he states, are either complete Ascomycetous forms, or incomplete conidial stages. He does not make any new species, although many of the plants he has so carefully described must be new to science. These fungi often attack insects in epidemic fashion. Some of them have been successfully employed in the United States against scale-pests. As moisture and warmth favour their growth, Ceylon, the author considers, should be a suitable country for testing their efficacy as a remedy for scale-attacks. Tables are added of the fungus species and their hosts.

Harmful Fungi.†—K. von Tubeuf calls attention to the damage that may be done by the fungus *Thelephora laciniata*. It is not a parasite, but it spreads over the ground in a compact manner and smothers vegetation. It is particularly hurtful to young trees.

He records ‡ the occurrence of witches' brooms on *Prunus Padus*. It was probably caused by an *Exoascus*, but asci were not found.

He also publishes § a note on the occurrence of *Trametes Pini* in Bavaria. Though rare on pines, it is found frequently on other Conifers. A fossil wood destroyed by *Trametes Pini* has also been found.

Plant Diseases.‖—Fr. Bubak reports on the work on parasitic fungi done at Tabor (Bohemia) in 1904. He notes the almost complete disappearance of *Rhizoctonia violacea* from a district where it had been frequently met with. Considerable work was done on various forms of Uredineæ. *Æcidium Seseli* was found to be a form of *Uromyces graminis*. The relationships of several other forms were verified. A number of new diseases caused by fungi were chronicled.

G. G. Hedgcock ¶ describes a disease of cauliflower and cabbage caused by *Sclerotinia Libertiani*. Sclerotia were rather rare. The *Peziza* form was produced in abundance in the cultures of the fungus.** He also gives an account of an attack of *Agave* by *Colletotrichum Agaves*. Young plants were quickly destroyed. Bordeaux mixture is recommended as a suitable fungicide.

* Ann. Roy. Bot. Gard. Peradeniya, iii. (1906) pp. 11–82 (4 pls.).
† Nat. Zeitschr. Land. Forstw., iii. (1905) pp. 91–2. See also Bot. Centralbl., ci. (1906) p. 452.
‡ Tom. cit., pp. 395–7. See also Bot. Centralbl., ci. (1906) p. 453.
§ Op. cit., iv. (1906) pp. 96–100. See also Bot. Centralbl., ci. (1906) p. 453.
‖ Zeitschr. Landw. Versuch. Oesterr. (1905) 4 pp.
¶ Rep. Miss. Bot. Gard. St. Louis (1905) pp. 149–51 (3 pls.).
** Tom. cit., pp. 153-6 (3 pls.).

H. Klebahn * has investigated a fungus that attacks the bark and flower-buds of *Syringa*. He found, in the intercellular spaces, resting spores which, in their development, recalled the oospores, oogonia, and antheridia of the Peronosporeæ, but no conidial form was found. In artificial cultures he discovered that the hyphæ were non-septate, but at intervals a ring-shaped thickening of the wall is formed. Oogonia and antheridia were also produced in these cultures. Klebahn places the fungus in the Peronosporeæ, from which it differs in the absence of conidial formation, and names it *Phlæophthora Syringa* g. et sp. n.

A disease of tomatoes was found by V. Oven † to be due to *Fusarium erubescens* sp. n. It attacks and shrivels the fruit and the stalk. The fungus is a variable form, producing micro- and macrogonidia, chlamydospores, and sclerotia.

H. C. Schellenberg ‡ found a number of thirty-year-old fir trees destroyed on the Adlisberg. They showed a strong infection of *Dasyscypha calyciformis*, identical with the fungus that attacks other Conifers. It is a wound parasite, and its growth is favoured by a too close planting of the trees, and by a damp atmosphere. The crown branches were most frequently attacked and growth was arrested.

R. Laubert § chronicles a bad disease of *Prunus Padus* caused by *Sclerotinia Padi*. The fungus attacks the leaves, where it forms spores which infect the opening flowers. Sclerotia are formed in the flower, and in the following spring the *Sclerotinia* grow from the sclerotia, and the ascospores re-infect the young leaves.

J. M. Van Hook ‖ gives an account of a serious outbreak of disease of seed peas caused by *Ascochyta Pisi*. Stem, leaves, and pods were attacked by the fungus. It grows through the husk of the pod and destroys the seed. The writer describes the development of the fungus and the course of the disease. He also gives methods of treatment. Peas should not be re-planted on the same area, as the fungus lives on in the soil or compost as well as in the seed peas.

Myxobacteria.¶—Alfred Quehl recalls to students the work done and published on these organisms, and gives us the results of his collections in the neighbourhood of Berlin, and of his laboratory cultures. He has the same experience as others have had, that these bacteria are nearly always found on laboratory material, very rarely in the open. He explains this by their fragility and their susceptibility to moisture, which causes the forms to collapse. He records a large number of species already found by Thaxter in North America, and he adds a number of new species in the genera *Polyangium* and *Myxococcus*. He thinks that the new species, *Myxococcus pyriformis* A. L. Sm., the only species recorded as yet for Britain, is probably a good species on account of its

* Centralbl. Bakt., xv. (1905) p. 335. See also Ann. Mycol., iv. (1906) p. 96.
† Landw. Jahrb., xxxiv. (1905) pp. 489–521. See also Ann. Mycol., iv. (1906) pp. 96–7.
‡ Nat. Zeitschr. Land. Forstw., xii. (1905) p. 512. See also Ann. Mycol., iv. (1906) p. 98.
§ Gartenflora, 1905, p. 169 (1 pl.). See also Bot. Centralbl., ci. (1906) p. 530.
‖ Ohio Nat., vi. (1906) pp. 507–12.
¶ Centralbl. Bakt., xvi. (1906) pp. 9–34 (1 pl. and 3 figs.).

form and colour, but that it might possibly be a form of *Myxococcus rubescens*, which is a very variable species.

He devoted special attention to the germination of the spores, and followed it out in *Myxococcus rubescens*. After 3–4 hours they were found to have increased in size; then they passed through an oval to a rod-shaped form. In this stage motion begins, and growth in length continues. Further, he notes that germination takes place by a small portion of the spore going through these stages more rapidly than the rest of the spore. He compares these results with those of Baur and Thaxter, and he gives his observations as to the influence of temperature and media on the growth of the organisms. He also records a series of observations on the development of the cystophore, stalk, and head.

BUBAK, FRANZ—**Zweiter Beitrag zur Pilzflora von Montenegro.** (Second contribution to the fungus flora of Montenegro.)
[The list includes 256 species, of which 66 are new to science. There are two new genera, *Schönbornia* (Excipulaceæ) and *Trichofusarium* (Tuberculariaceæ).] *Bull. Herb. Boissier*, vi. (1906) pp. 393–408 and 473–88 (2 pls.).

BUTJAGIN, P. W.—**Die chemischen Veränderungen des Fleisches beim Schimmeln.** (The chemical changes in flesh induced by fungi.)
[Spores of *Penicillium glaucum* and *Aspergillus niger* were sown on sterilised meat, and the changes noted.]
Arch. Hygiene, lii. (1905) pp. 1–21 (2 pls.). See also *Bot. Centralbl.*, ci. (1906) p. 568.

FAULL, J. H.—**A Preliminary Note on Ascus and Spore Formation in the Laboulbeniaceæ.** *Science* (n.s.) xxiii. (1906) p. 152. See also *Bot. Centralbl.*, ci. (1906) p. 417.

HENNINGS, P.—**Fungi Africæ orientalis. IV.**
[The fungi were collected by Zimmermann and others in East Africa. Many new species are described, and one new genus of Fungi imperfecti, *Ascochytopsis*.]
Engler's Bot. Jahrb,, xxxviii. (1905) pp. 102–18. See also *Bot. Centralbl.*, ci. (1906) pp. 446–7.

„ „ **Fungi Camerunenses II.**
[Many new species are included in the list.]
Tom. cit., pp. 119–29. See also *Bot. Centralbl.*, ci. (1906) pp. 447–8.

HENNINGS, P., LINDAU, G., LINDNER, P., & NEGER, F.—**Kryptogamenflora der Mark Brandenburg.**
[The different authors take up the various orders and genera.]
Leipzig: Gebr. Borntraeger, (1905) vii. pp. 1–160. See also *Ann. Mycol.*, iv. (1906) pp. 89–90.

JAAP, D.—**Fungi selecti exsiccati.**
[Nearly all the species have been collected in Switzerland, Brandenburg, and near Hamburg.] Serie vii., Nos. 151–75, March 1906. See also *Bot. Centralbl.*, ci. (1906) p. 497.

KRIEGER, K. W.—**Fungi Saxonici exsiccati. Fasc. 39.** (Fungi from Saxony.) Konigstein, 1906. See also *Bot. Centralbl.*, ci. (1906) p. 498.

„ „ **Einige neue Pilze aus Sachsen.** (Some new fungi from Saxony.) *Ann. Mycol.*, iv. (1906) pp. 39–40.

MAUBLANC, A.—**Sur quelques espèces nouvelles ou peu connues de Champignons inférieurs.** (Some new or little known species of lower fungi.)
[There is one new genus, *Melanobasidium* (Hyphomycete).]
Bull. Soc. Mycol. France, xxii. (1906) pp. 63–70 (13 figs.).

MAUBLANC, A.—**Quelques Champignons de l'est Africain.** (Some fungi from East Africa. *Tom. cit.*, pp. 71–6 (3 figs.).

OERTEL, G.—**Eine neue Rhabdospora-Art.** (A new species, *Rhabdospora Saccardiana.*) *Ann. Mycol.*, iv. (1906) p. 35 (1 fig.).

PATOUILLARD, N.—**Champignons recueillis par M. Seurat dans la Polynésie française.** (Fungi collected by M. Seurat in French Polynesia.)
[There is one new genus, *Mappea* (Basidiomycetes).]
Bull. Soc. Mycol. France, xxii. (1906) pp. 45–62 (2 pls.).

PECK, C. H.—**New Species of Fungi.**
[The larger and smaller fungi are both represented in the list.]
Bull. Torrey Bot. Club, xxxiii. (1906) pp. 213–21.

PETCH, I.—**Descriptions of New Ceylon Fungi.**
[The fungi are all parasitic, and cause more or less damage to their hosts.]
Ann. Roy. Bot. Gard. Peradeniya, iii. (1906) pp. 1–10.

POIRAULT, J.—**Liste des Champignons supérieurs de la Haute-Vienne (Suite).**
[List of fungi from Haute-Vienne.]
Bull. Acad. Géogr. Bot., 1905, Nos. 185–6, pp. 73–7.
See also *Bot. Centralbl.*, ci. (1906) p. 672.

PRINGSHEIM, HANS H.—**Ueber die sogenannte "Bios-Frage" und die Gewöhnung der Hefe an gezuckerte Mineralsalznährlösungen.** (The so-called "Bios-Question," and the accustoming of yeast to a mineral solution.)
Centralbl. Bakt., xvi. (1906) pp. 111–19.

REHM—**Ascomycetes exs. Fasc. 36.**
[Nos. 1626 to 1650 are listed; a number of them are new to science.]
Ann. Mycol., iv. (1906) pp. 64–71.

ROSTRUP, E.—**Norges Hymenomycetes. Efter Forfatterens Död gennemset og afsluttet af Axel Blytt.** (Norwegian Hymenomycetes collected and named by Axel Blytt, and published by Rostrup after Blytt's death.)
Videns-Selsk. Skrift. 1 *Math-Naturw. Kl.*, 1904, No. 6
(Christiana, 1905) pp. 1–164. See also
Ann. Mycol., iv. (1906) p. 93.

SACCARDO, P. A.—**Mycetes aliquot congoenses novi.** (Some new fungi from the Congo.)
[A list of known species is given, and descriptions of new forms. There are ten new species or varieties of *Xylaria.*]
Ann. Mycol., iv. (1906) pp. 72–7 (1 pl.).

STARBÄK, KARL—**Ascomyceten der Schwedischen Chaco-Cordilleren Expedition.**
[The new genera recorded are *Robertomyces* and *Hypoxylina*. Many new species are described.] *Arkiv Bot.*, v. (1905) No. 7, pp. 1–35 (1 pl.).

SYDOW, H. & P.—**Neue und kritsche Uredineen. IV.** (New and critical Uredineæ.)
[Species of *Uromyces*, *Puccinia*, and *Uredo* are described.]
Ann. Mycol., iv. (1906) pp. 28–32.

Lichens.

(By A. LORRAIN SMITH.)

Subterranean Lichens.*—Among the forms of vegetation described by Jacques Maheu as occurring in caverns, there are a fair number of lichens. They are confined, however, almost exclusively to the entrance; they do not penetrate into the depths of the caverns, less, Maheu thinks, on account of the darkness than because of the great humidity. Some live in semi-obscurity, but they are very deformed; a few crustaceous forms grow right in the caverns. The substratum seems to be one of the most important factors in the case: while there were but few in the lime

* Ann. Sci. Nat., ser. 9, iii. (1906) pp. 98–101.

caverns, there were still fewer on soils composed of gypsum, and on the latter substratum the thallus was less developed, and usually more sinuous. On silica both species and individuals are rare.

American Lichens.—While publishing a list of lichens from the Peterboro Hills in New England, R. Heber Howe* insists on the extreme desirability of such local lists being made all over the country, in order that the distribution of lichens may become better known. The list he himself has made includes 38 species which were all collected in one outing. Specimens merely observed were not enumerated; only those that were collected.

C. W. Harris † publishes also a local list of lichens collected at Chilson Lake, New York. The number is much larger, and many interesting forms are included.

A short note by Bruce Fink ‡ announces a Field Book for Beginners called "Common and Conspicuous Lichens of New England," to be published in serial parts by R. H. and M. A. Howe. Readers are warned that microscopic examination is absolutely necessary for the determination of many species.

R. Heber Howe § also gives further information about the distribution of *Ramalina rigida*. He finds that it has quite a wide range along the New England coast.

ELENKIN, A. A.—**Species novæ lichenum in Sibiria arctica a cl. Birula-Bialynizki collectæ (expeditio baronis Tol.)** (New species of Lichens from Arctic Siberia, collected by Birula-Bialynizki.)
[Species of *Parmelia* and *Placodium* are described.]
Ann Mycol., iv. (1906) pp. 36–8.

JATTA, A.—**Lichenes lecti in Chili a cl. G. J. Scott Elliott, quos determinavit.** (Lichens collected in Chili by Scott Elliott, and determined by A. Jatta.)
[The list includes several new species.] *Malpighia*, xx. (1906) pp. 3–18.

Myxomycetes.

Study of Myxomycete.‖—G. Nadson and A. Raitschenko found *Enteromyxa paludosa* in a dish containing water and algæ from a pond. It lives on the unicellular *Synechococcus æruginosus*, one of the Cyanophyceæ. Sporocysts are formed containing usually 3–6 spores; germination was not observed. The authors consider the organism to be a Myxomycete belonging to the group Endosporeæ.

Schizophyta.

Schizomycetes.

Bacillus violarius acetonicus: an Acetone-producing Microbe.¶ L. Bréaudat describes a chromogenic microbe isolated from the drinking water of Saigon (Cochin China), which produces acetone from proteid matter. It is a short bacillus with rapid oscillatory movement, staining

* Bryologist, ix. (1906) pp. 46–8. † Tom. cit., pp. 48–52.
‡ Tom. cit., p. 52. § Tom. cit., p. 54.
‖ Scripta Bot. Hort. Univ. Petrop., fasc. xxiii. (St. Petersburg, 1905) 18 pp., 4 pls. See also Ann. Mycol., iv. (1906) p. 100.
¶ Comptes Rendus, cxlii. (1906) p. 1280.

easily and appearing oval with a clear centre and deeply coloured extremities; it does not stain by Gram's method; it is a potential aerobe, grows well at all temperatures between 30° and 37° C., and forms round spores at about the sixth day; on peptone-agar it forms violet colonies, and on potato a thick deep violet almost black expansion; it grows well on liquid media, but produces no pigment in the absence of peptone, or in the absence of air; it produces acetone in peptone solutions, and also ethylic alcohol and volatile acids; it liquefies gelatin; it reduces nitrates to nitrites without forming gas; it coagulates milk, the culture becoming acid, and the coagulum being slowly and completely liquefied, the liquid containing casease. The author demonstrates the formation of acetone, by inoculating a mixture containing peptone, saccharose, sodium carbonate, and water, with a three-days-old culture, and subjecting this, after incubation for a month at 30° C., to repeated distillations. The amount of acetone is estimated by Jolles' method, which consists in combining the acetone with bisulphite of soda and titrating to find the amount of the salt that has combined. The author finds that about 0·78 gr. of acetone is yielded by a litre of culture. He proposes to name the organism *Bacillus violarius acetonicus*.

Cytology of Bacteria.*—A. Guilliermond describes his examination of *Bacillus radicosus*, which from its large size permits a study of its structure. In a less than ten-hours-old culture, after fixation in Zenker's fluid and staining with iron-hæmatoxylin, almost every cell shows a large deeply stained central granule, which represents the first appearance of the site of transverse fission, and is formed by the union of two small lateral granules apparently derived from a concentration of the cytoplasm; this large granule, or biconcave disk, divides into two coloured bands through which the division of the two cells is effected. After 10 to 12 hours the cytoplasm becomes vacuolated and filled with fine stained granules of varying size, and later shows an alveolar structure filled with fine granules resembling granules of chromatin. The spore appears at one of the poles as a small deeply stained granule; it enlarges, takes an oval form, and becomes surrounded by a thick membrane which prevents the penetration of stains. The spore appears to be derived in part from a condensation of the granules of the cytoplasm.

The author concludes that a true nucleus does not exist in a bacterium, and that such as have been described by various authors are misrepresentations, but agrees with Schaudinn that bacteria contain a chromatin more or less mixed with the cytoplasm, differentiated at times and constituting the greater part of the spore.

Streptococcus Bombycis and Disease in Silkworms.†—S. Sartirana and A. Paccanaro made agar and gelatin plates from emulsions of the bodies of silkworms that had died from "consumption," and isolated in every case, besides various bacilli, a streptococcus which in cultural and morphological characters resembled the *Streptococcus bombycis* of other authors. It occurs in the worm and in the cultures as short chains

* Comptes Rendus, cxlii. (1906) p. 1285.
† Centralbl. Bakt., 1te Abt. Orig., xl. (1906) p. 207.

of small cocci, stains by the ordinary dyes, and also by Gram's method; on gelatin it forms small greyish yellow round colonies, and causes no liquefaction; it grows slowly on plain agar, the colonies having a deep brown colour; it grows well on agar with guinea-pig or worm blood. Pure broth culture was inoculated into adult worms by the dorsal vessel, by the mouth, and by the stigmata, and from the results of these experiments the authors conclude that the *Streptococcus bombycis* must be regarded as the specific cause of the disease, which has the nature of a chronic enteritis. The authors think that the lethargy, so often one of the morbid phenomena, should not be considered as a special disease caused by a specific micro-organism, but as a result of a mixed infection.

Chemical Action of Bacillus lactis aerogenes on Glucose and Mannitol.*—A. Harden and G. S. Walpole, from quantitative examinations of the products of the fermentation of glucose and mannitol by *Bacillus lactis aerogenes*, showed that the ferment action differed from that of *Bacillus coli*, a proportion of 2 : 3 butylene-glycol and acetylmethylcarbinol, in the first case, being derived from the glucose. The authors point out that the alcohol produced by the *Bacillus lactis aerogenes* is slightly greater in amount than that produced by *Bacillus coli*, and that it is at the expense of that part of the molecule which in *Bacillus coli* fermentation yields acetic acid and lactic acid, that the *Bacillus lactis aerogenes* forms the new products.

Resistance of Bacillus coli to Heat.†—St. de M. Gage and G. v. E. Stoughton have made a number of experiments on the resistance of *Bacillus coli* to heat. They find that in every culture a few of these organisms exhibit an extraordinary resistance, surviving in some cases 90° C. for five minutes; there was no evidence of true spores; all attempts failed to obtain by subculturing a special highly resistant strain of this organism. The temperature at which final sterilisation occurred varied from 60° C. to 95° C. in 18 different tests; the thermal death point of the majority of the bacteria was between 50° C. and 55° C.

The authors consider that the results obtained in the determinations of the normal thermal death point would lead to the belief that its application in the identification of bacterial species would be of more value than the determination of the absolute thermal death point.

Plasmoptysis of Bacteria.‡—A. Fischer has shown that plasmoptysis is an appearance found widely distributed among bacterial cultures. In order to demonstrate this, the organism must be allowed to develop in an unfavourable medium. The comma bacillus of Finkler Prior especially shows this pleomorphism. The medium used by the author was alkaline fleisch-wasser, to which was added 1 p.c. peptone and 1 p.c. cane sugar, and used as broth or with agar; after a few hours at 32° C., many of the vibrios have taken on oval or spherical forms, all more or less motile; later, these forms show short outgrowing stalks, often giving the appearance of a *Cyclops* with its pair of egg-cases, these forms being very numerous by the sixteenth hour; later, the vibrios are regenerated. Hanging drops of fourteen-hour broth cultures were pre-

* Proc. Roy. Soc., Series B, lxxvii. (1906) p. 399.
† Technology Quarterly, xix. (1906) p. 41.
‡ Ber. Deutsch. Bot. Gesell., xxiv. (1906) p. 55.

pared with incompletely closed chambers, so that the organism could be exposed to the influence of various volatile substances such as ammonia, acetic acid, formic acid : the author gives minute details in hours and fractions of a minute at which the various appearances occur in the organisms in the drop.

The author cannot decide whether the plasmoptysis is to be attributed to changes in the elasticity of the cell membrane, or to a gradual impermeability of the protoplasm, whether due to changes in the osmotic action of substances inside the vibrio, or in the broth. Similar effects were observed with other vibrios, and also with the hay bacillus.

Significance of the Anaerobic Putrefactive Bacilli in the Ripening of Cheese.*—A. Rodella, from chemical analysis of cultures, finds that various anaerobic putrefactive bacilli set up fermentations that produce butyric acid, valerianic acid, and caprionic acid, the amounts of which he estimates as salts of silver after the method of Orla Jensen. The author has isolated these organisms, and described their cultural characteristics.

Bacillus leguminiperdus sp. n.†—E. Oven describes a disease affecting the pods of peas and various beans, and which is caused by an actively motile bacillus that rapidly liquefies gelatin. Inoculation of healthy plants showed that the pods were not necessarily affected through any abrasion of the surface. Owing to the greater density of the inner wall of the pod, the disease does not penetrate to this part. A moist atmosphere favours the growth of the organism. The author finds that the seeds may become infected from the soil, and that every part of the plant may be attacked.

The organism is a short rod $0 \cdot 8 \mu$ by 2μ–$2 \cdot 3 \mu$, very motile, with polar flagella 2–3 times the length of the bacillary body. It does not stain by Gram's method; sporulation occurs readily in fluid media, the spore being single, and situated at either end of the rod; neither fermentation of sugar media, nor production of indol, was ever observed.

The author has named the organism *Bacillus leguminiperdus* sp.n., but it is probable that other plants besides the Leguminosæ are susceptible to this bacillus.

Tuberculosis of the "Bee-moth" (Galeria melonella).‡—S. Metalnikoff finds that to the tubercle of man, beasts and birds, the grub of the "bee-moth" is immune, as is shown by the rapid destruction (under an hour) of the tubercle bacillus in the phagocytes, and in certain cases also in the blood plasma of the grub. When, however, the animal is inoculated with fish tubercle bacilli, these rapidly increase, and the grub dies.

Bacterial Flora of Bottled Beer.§—F. Fuhrmann has observed the presence of *Pseudomonas cerevisiæ* in bottled beer; it occurs as a short, actively motile rod with a bunch of 4–6 fine wavy flagella at one end. On neutral nutrient gelatin at 22° C. it forms round, slightly yellow, translucent colonies cupped in the centre; after prolonged growth a slight sinking in of the gelatin occurs, though there is true liquefaction

* Centralbl. Bakt., 2te Abt., xvi. (1906) p. 52.
† Tom. cit., p. 67.
‡ Op. cit., 1te Abt. Orig., xli. (1906) p. 188.
§ Op. cit., 2te Abt. xvi. (1906) p. 309.

only when there are many closely applied colonies. It forms yellowish, moist, shining colonies on moist, neutral nutrient agar at 22° C., and after a few days a yellow colour is diffused through the medium. It grows as a moist, shining yellow brown expansion on potato; in broth, a grey pellicle is formed, the medium is uniformly clouded, and there is a yellow deposit, and later the liquid acquires a bright yellow colour. Its optimum temperature is 22° C.; at higher temperatures it forms long rods and threads, with slow, snake-like movements; in glucose broth it produces no gas; it forms no indol, even after prolonged growth in pepton-water and broth cultures; it is a facultative anaerobe; it grows on mineral media, and in tubes of calcium nitrate there is formation of nitrite. It is killed by exposure to 60° C. for an hour and a half; in beer containing 4–5 p.c. alcohol its resistance to heat is much diminished, and it is sterilised within half an hour.

Bacteriology of Summer Diarrhœa of Infants.*—H. de R. Morgan, from the results of an extended examination of the stools from 58 cases, has selected three organisms as possible causes of the disease. Bacillus No. 1, which is not normally present in human stools, sewage, or drinking water, was isolated in 28 cases; it caused diarrhœa and death in young animals, and could be isolated in pure culture from the spleens; but in no case did the patient's blood agglutinate this organism. Bacillus No. 3 was isolated in five cases, and in one instance the patient's blood agglutinated this organism, and also the *Bacillus typhosus*, and it was shown that this bacillus was agglutinated equally well by dysentery (Flexner) serum and by typhoid serum; this organism was pathogenic to young rats which were fed on it, but produced no diarrhœa. Bacillus No. 4 was isolated in three cases, and was selected chiefly on account of its resemblance to the Flexner group of dysentery bacilli; this organism was pathogenic to young rats.

The author regrets that in no case was the blood or the spleen of fatal cases examined bacteriologically.

Virus of Glanders in Urine.†—G. Cagnetto finds that the *Bacillus mallei* appears in the urine of animals (horse, donkey, cat, and man) affected with glanders after 30–35 hours, and retains its pathogenic properties for at most 3–4 days, but undergoes remarkable morphological changes and diminution of its virulence. These changes appear much sooner in the urine of infected animals than in the urine of healthy animals, probably on account of some specific antibody that passes over from the blood into the urine.

The diminished vitality of *B. mallei* when in contact with the urine of infected animals is more marked in regard to its behaviour on artificial media than in its pathogenic action. The bacillus loses its virulence completely in horse urine when dried, after 20 hours.

Bacillus choreæ paralyticæ ovis.‡—D. J. Hamilton describes an organism found in the peritoneal fluid of sheep affected with "louping-

* Brit. Med. Journ., 1906, i., p. 908.
† Centralbl. Bakt., 1te Abt. Orig., xli. (1906) p. 173.
‡ Board of Agriculture Report, 1906. See also Brit. Med. Journ., 1906, i. p. 1472.

ill." It is a coarse-looking rod with rounded ends, sometimes elongating into a thread, or it may be into a chain of rods. Its breadth is over 1 μ, and in length it varies from 3–12 μ or more; it is feebly motile, and forms spores with central or polar location.

It is an essential anaerobe, and grows best on alkalin-glucose broth and glucose-gelatin covered with oil. During germination a gas with putrefactive odour is evolved.

Italian Variety of Nitrosomonas europæa.*—R. Perotti obtained samples of earth from different parts of Italy, and isolated therefrom in Omelianski's medium (ammon. sulph. 2, sodium chloride 2, potass. phosphate 1, magnesium sulphate 0·5, iron sulphate 0·4, distilled water 1000) a variety of *Nitrosomonas* with similar morphological characters. It mostly occurred as a small coccus 0·6–0·8 μ in diameter, but showed indications of transition to bacillus form. In the monad stage the organism possesses a flagellum equal in length to the bacterial body. The movements are slow and jerky. It does not develop in media containing organic substances; it produces nitrous acid from the salts of ammonium.

Bacillus alatus sp. n.†—R. Greig-Smith found this pleomorphic slime bacterium when isolating *Rhizobium leguminosarum* from the nodules of *Lupinus luteus*. It is a motile rodlet with numerous peritrichous flagella. When stained with fuchsin it is acid-fast to 5 p.c. HCl, but is negative to Gram. The shape and size of the capsule vary with the medium. It forms indol and reduces nitrates to nitrites, and coagulates milk at 55° C. On certain media with a vegetable base it forms a slime readily and luxuriantly; from the slime was obtained a thick mucilage with the reactions of arabin. The gum seems from its reactions to lie between Macrozamia gum and Gum Acacia.

Identity of Opsonins and Normal Agglutinins.‡—R. Greig-Smith finds that opsonins and agglutinins have many points of similarity, and probably no points of difference. The similarities are: (1) Staphylococcus opsonin and agglutinin are not destroyed at 60° C.—their powers are only in abeyance. Contact with the bacteria for 20 hours induces a recovery. (2) In dilute saline solutions the recovery of the opsonic power is accompanied by an agglutination of the bacteria. (3) Potassium chloride gives a greater agglutinative and a greater opsonic effect than sodium chloride. (4) Dilution of the serum with saline solutions increases the agglutinative and the relative opsonic effects. (5) Longer cultivation of a weak race of staphylococcus increases the agglutinability and the opsonisation of the cells.

Opsonisation appears to be the first phase of agglutination.

Phagocytosis in vitro.§—M. Löhlein undertook some experiments to confirm Metchnikoff's work on the ingestion of pathogenic organisms

* Atti R. Accad. Lincei, xv. (1906) pp. 512–16.
† Proc. Linn. Soc., N.S.W., xxx. (1906) pp. 570–3 (1 pl.).
‡ Tom. cit., pp. 555–69.
§ Ann. Inst. Pasteur, xix. (1905) p. 647.

by leucocytes freed from "substances sensibilatrices" (immune body, amboceptor).

The leucocytes were obtained by injecting bouillon into the peritoneal cavity of guinea-pigs, and in 5–8 hours the fluid removed, which was rich in polymorphs, was centrifuged and repeatedly washed with saline solution.

Hanging drop preparations were examined, and stained films at different periods made. A virulent anthrax culture suspended with leucocytes showed that ingestion started immediately at room temperature. Films showed very early traces of phagocytosis, and in 1–2 hours nearly all were ingested. Often several leucocytes united to ingest one large filament. Similar results were obtained with human leucocytes obtained by Wright's method. Attenuated staphylococci gave similar results, and also less virulent forms of streptococci. Two strains of coli were used *in vitro*, and controlled by injections *in vivo* into a guinea-pig's peritoneal cavity, the fluid being withdrawn in 4 hours. Coli J was rapidly ingested *in vitro*, and the peritoneal fluid showed numerous leucocytes stuffed with bacilli and granules, which latter also were found free, and subcultures could not be obtained. Coli C was not ingested *in vitro*, and only a few of the peritoneal leucocytes contained some bacilli and granules; there were only a few free granules, and abundant subcultures were obtained. In hanging drop neither the shape nor motility of coli was altered, but they were seized alive, often exhibiting a certain amount of motility inside the phagocyte. Degeneration inta round granules occurred apparently in vacuoles, appearing a few minutes after ingestion, although no change occurred outside the cells in 30 minutes. *Vibrio choleræ* likewise showed no extracellular change for ¾ hour, when some of them were altered and showed granules, but the leucocytes were then showing signs of degeneration (cf. Wright and Douglas that granulation is due to the sera). Stained films showed alteration after ingestion, and some filaments appeared partly ingested with different staining appearances of the intra- and extra-cellular portion.

Some further experiments are described with a view to determine the bacteriolytic action of the phagocytes, and tend to show that, whilst growth of bacteria is inhibited after treating with washed leucocytes, it is unaffected by leucocytes heated to 55° C. Anthrax was also found to be unaffected after treatment with guinea-pig's serum, but was inhibited by peritoneal fluid of a guinea-pig. The author shortly discusses the view that the leucocyte contains both an amboceptor and a cytase, and summarises his work as follows. Guinea-pigs' leucocytes, washed frequently to remove any "substances sensibilatrices" contained in the plasma, or any other substance capable of aiding phagocytosis, incorporate and digest *in vitro* pathogenic microbes (anthrax, cholera, some varieties of streptococcus, and *B. coli*); thus showing that phagocytosis is a cell phenomenon which may occur without the intervention of active bodies contained in the plasma. Some microbes, however, such as certain varieties of streptococcus and *B. coli*, are not easily phagocyted either *in vivo* or *in vitro*.

MICROSCOPY.

A. Instruments, Accessories, &c.*

(1) Stands.

Zeiss' Large Mechanical Stage.†—This stage (fig. 54) has a range of 50 mm. (2 in.) in one direction, and 35 mm. ($1\frac{3}{8}$ in.) in the other;

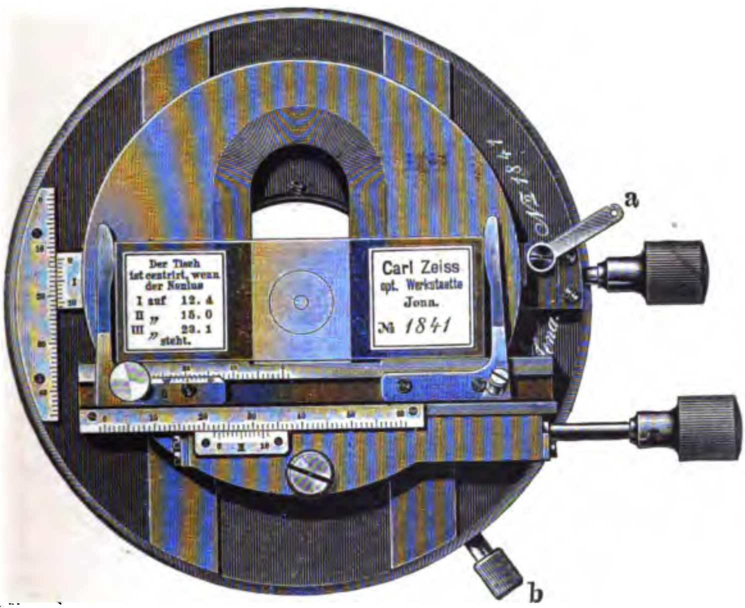

FIG. 54.

vernier scales record the variations in either direction. A third vernier scale enables the portions of the movable cheek-piece which secures the object-slide to be recorded. This arrangement facilitates the use of the apparatus as a "finder," while the process of centring is much simplified by the use of a centring glass, i.e. a slide with a cross ruled on it.

Zeiss' Stand for Crystallographic and Petrographic Work.‡—This instrument (fig. 55) is an example of a medium sized stand, and is so

* This subdivision contains (1) Stands; (2) Eye-pieces and Objectives; (3) Illuminating and other Apparatus; (4) Photomicrography; (5) Microscopical Optics and Manipulation; (6) Miscellaneous.

† Carl Zeiss' Catalogue of Microscopes and Microscopical Accessories, 33rd ed. 1906, p. 36 (fig. 14).

‡ Tom. cit., pp. 50–1 (fig. 22).

Fig. 53

constructed as to allow of subsequent additions to the stage and sub-stage equipment. The body is fitted with Berger's micrometer movement, and the draw-tube is at its lower end provided with a slide to admit a mounted Amici-Bertrand lens through an opening in the outer tube. The instrument is furnished with analysers and polariser, with selenite, mica, and Biot-Klein quartz plates—suitable arrangement being made for inserting these plates in a sliding carrier above the objective. The revolving vulcanite stage is graduated at the circumference, and has a line index. The two upper lenses of the swing-out condenser, N.A. 1·40, are easily detachable, as their mount is not screwed but slipped on over the lowest lens. Additional accessory apparatus can be supplied.

(2) Eye-pieces and Objectives.

Zeiss' Compensating Ocular 4* with Iris Diaphragm.*—Messrs. C. Zeiss have modified one of their series of compensating oculars by fitting it with a collecting-lens of large diameter (fig. 56). As compared with its predecessor 4, its field is considerably enlarged, though only adapted for use with objectives of 16 mm. and 8 mm. The ocular is fitted with a revolving collar, and can be fixed in any desired position by means of the clamping-screw K. An iris diaphragm supersedes the ordinary fixed diaphragm. The eye-lens is mounted in a sliding sleeve, so that a scale can be used if required.

FIG 56.

Fluid Lenses.†—W. A. Rublee, U.S. Consul-General at Vienna, states that a Hungarian chemist has succeeded in producing optical lenses by a simple and cheap process that are not only quite as good as the best massive glass lenses at present used, but that can be manufactured of a size three times as great as the largest homogeneous glass lens heretofore made. Though the invention is more important for astronomical work, lenses of smaller diameter for photographic purposes, for opera glasses, reading glasses, etc., can be produced at correspondingly smaller cost. The lens consists of a fluid substance inclosed between two unusually hard glass surfaces, similar to watch crystals, in which the refractive power and other characteristic properties are so chosen that the glass surfaces not only serve to hold the fluid, but also combine with the fluid to overcome such defects as are scarcely to be avoided in ordinary lenses. It is for this reason that the lens is achromatic. The fluid contained in the lens is hermetically closed in, so that no air can enter and exercise a damaging influence. The fluid does not evaporate, and its composition is such that its properties are not affected by time or temperature. The coefficient of expansion, both of the glass and of the fluid, is approximately the same between the temperatures of

* Carl Zeiss' Catalogue of Microscopes and Microscopical Accessories, 33rd ed., 1906, p. 18 (fig. 5).
† English Mechanic, lxxxiii. (1906) p. 473.

15° of cold to 60° of heat. Another advantage of the lens is that on account of the fact that the fluid is not dense, and the glass crystals are thin, the whole lens combination through which the light penetrates is very slight.

MALASSEZ, M. L.—**Évaluation des distances foco-faciales des Objectifs.**
[The substance of this treatise has already appeared in the Journal: 1905, p. 500, and 1906, pp. 362–3]. *Comptes Rendus*, cxlii. (1906) pp. 926–8.

(3) Illuminating and other Apparatus.

Zeiss' Centring Achromatic Condenser.*—In this condenser (fig. 57), N.A. 1·0, and equivalent focal length 14 mm., the stopping down

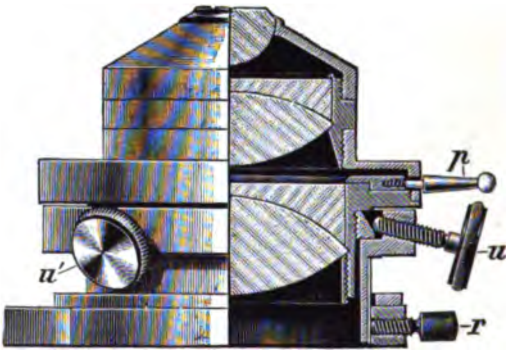

FIG. 57.

of the illuminating rays is effected by means of an iris diaphragm situated between the lenses. This entails a full opening of the diaphragm of the illuminating apparatus.

Spectrohelioscope (A. Sauve).—New Arrangement for procuring a Monochromatic Image of a Light-Source (A. Nodon).†—Both A. Sauve and A. Nodon, under the above dissimilar titles, have independently studied the improvement of spectroheliographs for photographing the sun's image with light of definite wave-length. Both authors have endeavoured to find means whereby the heavy spectrograph itself should be at rest during use, and whereby all adjustment should be attained by movement of the mirror which reflects the light on to the slit. In Sauve's arrangement, the light which at first falls on the front of the mirror is, after a series of reflections and refractions, made to fall on the back of the same mirror before the final reflection into the observation tube.

Nodon attains the same object by the use of two simple mirrors

* Carl Zeiss' Catalogue of Microscopes and Microscopical Accessories, 33rd ed. 1906, p. 31 (fig. 11).

† Mem. della Soc. degli Spettroscopisti Italiani, xxxiiii. (1904) p. 54. See also Comptes Rendus, cxli. (1905) p. 1010; and Zeit. f. Instr., xxvi. (1906) pp. 129–30.

which can be clamped together on the same axis at any desired angle. The first mirror throws the beam of light, issuing from the projection-lens, direct on to the first slit of the spectral apparatus. The light emergent from the second slit is then reflected by a fixed mirror on to the second adjustable mirror, and thence into the observation tube.

Spectroscope with Adjustable Dispersion.*—P. Krüss found that the desirability of this instrument was suggested by the requirements of the dyeing industry. Most colouring materials have characteristic spectra, and it is, therefore, obviously necessary to make the spectrum as clear and as perfect as possible. It is found, however, that the spectrum is dependent on several factors, e.g. the most suitable solvent, the proper degree of concentration of that solvent, and the thickness of the layer placed before the slit of the instrument. But, in addition to these fairly obvious factors, the spectrum of a dye usually requires a suitable dispersion. A dispersion suitable for one medium may be so unsuitable for another that the absorption bands may be indistinct and quite unrecognisable. At present the operator keeps several spectroscopes of various dispersive powers ready, but this inconvenience the author seeks

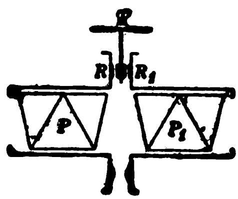

FIG. 58.

to remedy by the design of his instrument. He places two direct-vision prisms behind one another, and rotates them equally in opposite directions about their common optical axis. This arrangement is similar to that adopted by Abbe for his refractometer. The two opposed rims R, R_1 (fig. 58) of the tubes carrying the prisms P and P_1, are provided with engaging toothed wheels, and between these wheels is a driving wheel T, by which the two tubes are rotated through exactly equal angles in opposite directions. The two prisms P and P_1, are perfectly similar to one another, and are direct-vision for a ray of medium wave-length. If one prism has a dispersion D, then the total dispersion will be 2 D. If each is rotated through 90°, then the total is zero. Thus the limits lie between 2 D and 0. If ϕ be the angle of rotation, measured from the position in which the refracting edges of both prisms are perpendicular to the direction of the slit, and if d be the length of the spectrum measured, from the ray which passes without deviation to a ray of desired wave-length, then the combined dispersion parallel to the slit is zero, and perpendicular to the slit $2\,d \sin \phi$; hence only the latter has to be measured. If the absorption-band attained in a single-prism

* Zeit. f. Instr., xxvi. (1906) pp. 139–42 (2 figs.).

spectrum has a breadth $b = d\ d_1$, then the breadth with two-prism spectrum will be $2\ b \sin \phi$.

Fig. 59 represents a spectroscope equipped with such a direct-vision prism combination. The sleeve-collar of the one prism is provided with an external drum graduated in degrees.

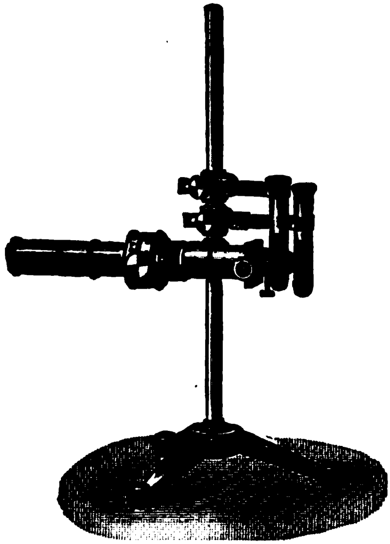

FIG. 59.

TUTTON, A. E. H.—**Das Elasmometer, ein neuer Interferenz-Elastizitätsapparat.**
[Full details and diagrams of this elaborate machine are given.]
Zeit. f. Krystallogr. u. Miner., xxxix. (1904) p. 321.
See also *Zeit. f. Instr.*, xxvi. (1906) pp. 163–7 (2 figs.).

(5) Microscopical Optics and Manipulation.

Interferences produced by a Network limiting a thin Lamella.* G. Meslin gives an explanation of the rings observed when a network is placed on the convex surface of a lens of weak curvature, the strands of the net being perpendicular to the plane of incidence. Such rings are distinguished from Newton's rings by the following properties :—

1. They are much wider and much further apart.
2. They are visible in white light, even if network and lens are not only not in contact, but several millimetres apart.
3. They are scarcely iridescent, and when viewed at an angle of 45° they are sensibly achromatic.
4. The diameter of these circles diminishes when the incidence increases : with Newton's rings the opposite effect holds.

The author attributes the phenomenon to the interference of the

* Comptes Rendus, cxlii. (1906) pp. 1039–42.

two beams which, although having been both reflected in the thin lamella, have undergone diffraction by the net, one at its entrance into the lamella, and the other at its emergence. These fringes can be rendered more brilliant by increasing the reflecting power of the lower surface, e.g. by employing a metallic surface, a condition unfavourable for Newton's rings. The fringes can be used with white light for conveniently verifying the form of the lower surface, whether it be of glass, of metal, or of mercury.

Entoptic Vision and the Entoptiscope.*—If a pinhole perforation through a card, or similar opaque object, be turned towards the light and held close to the eye, a circular disk is seen, which is the shadow cast by the circular aperture of the iris. By such means small opacities in the path of the rays in the eye are projected on the retina and become visible. This method of self-examination of obscurities within the eyeball is termed entoptic. A casual experiment of this kind led W. F. Barrett to the unwelcome discovery that he had incipient cataract of both eyes. The entoptiscope is an instrument which he has invented for viewing, delineating, and measuring entoptic objects. Pl. XVII., fig. 1, shows the first form of the designer's entoptiscope. It consists of a pair of vertical brass pillars supporting a head rest, which can slide from side to side so as to bring either eye vertically over the pin-hole contained in the revolving diaphragm of the eye-pieee. This diaphragm has pin-hole apertures varying in diameter from 0·1 to 2·5 mm., and a pair of pin-holes each 0·1 mm. diameter, and 2 mm. apart, so that by revolving the diaphragm either a single aperture of any given size, or a double aperture, can be successively brought before the eye. Below the pin-hole eye-piece is a transparent scale divided into fractions of a millimetre; the shadow of this scale falls upon the eye of the observer, and is thence projected, much magnified, upon the ground-glass stage below, along with the shadows of any opacities seen in the eye. At the base of the instrument is a concave mirror, which can be adjusted so as to illuminate the eye-piece brilliantly, using the light of the sky or that of a lamp. A sharply-pointed and hard pencil is used by the observer to trace the image seen on the ground-glass stage. The image of the pupillary disk, the projected shadow of the opacities in the eye, and the pencil point, are all seen in the same plane with perfect clearness. After the drawing has been made the ground-glass can be removed and photographed for future comparison. A later form of the instrument is shown in Pl. XVII. fig. 2. The vertical pillar P is hinged so that the observer may incline it to suit himself; a single pillar is used so as to leave the hand free to draw on the ground-glass stage G, which carries a supporting hand-rest R. The eye-pieces E E have cups shaped to fit the eye and bring the cornea within a definite distance of the pin-hole. In this way the pin-hole can be placed at the anterior focus of the eye (above half an inch from the cornea), and the stage is placed at a fixed distance so as to give a definite magnification. It is important that the observer in using the entoptiscope should be comfortably seated and completely at ease; he should have his hands

* Scientific Proc. Royal Dublin Soc., xi., Nos. 7-8, March and May 1906.

free and not be troubled to keep one eye closed—it is much better, in fact, to keep both eyes open. This is done in using either of the instruments; in the smaller one the shaped sliding head-rest keeps all light from reaching the eyes except through the single revolving diaphragm; in the larger one there are two revolving diaphragms, one (shown at D) for each of the eye-pieces E E. The eye that is not under observation is kept in complete darkness by turning D until the index marks zero; at this position there is no aperture in the diaphragm. Thus either eye can be occluded with ease. The mirror M is plane and not concave, and made sufficiently large to cover the whole of the ground-glass G with a flood of light reflected from a neighbouring incandescent gas lamp or other source of light. As the mirror is carried by the stage and moves with it, the illumination of the field remains unaltered in adjusting the inclination of the pillar. The pillar, stage, and mirror move with stiff friction round the centre A, and can be clamped in any position. In order to avoid any shifting of the observer's head, and also to avoid fatigue, a hinged and padded head-rest H is fixed in such a position that the forehead rests comfortably upon it. The head-rest is also made to rise and fall, and there is an arrangement for accommodating the diaphragms to the distance between the eyes.*

WILSING, J.—**Über die Bildebenung bei Spektographen-Objektiven.**
[Shows how H. Hartmann's equations and conditions can be almost exactly satisfied by choice of certain kinds of glass.]
Zeit. f. Instr., xxvi. (1906) pp. 101-7.

(6) Miscellaneous.

Construction and Fittings of a Microscope Room.†—The following extracts are taken from the report of N. A. Cobb, who describes very fully the construction and fittings of his Microscope room at Honolulu. The report also deals with the illustration room, dark room, and the camera-lucida.

THE MICROSCOPE ROOM.

For many years it has been customary in the best laboratories to mount various instruments of precision upon pillars of stone or masonry deeply imbedded in wells in the ground and passing upward through the floors of the laboratory without contact. The object of this arrangement is to prevent tremors. It is not often that the Microscope has received such special attention, but wherever high powers are used and especially when photo-micrographs are being prepared, or whenever high-power camera-lucida drawings are being made, the reduction of vibration is an important factor in the success of the work. For many years the writer has had Microscopes mounted in this way, and hereby testifies strongly in favour of this method of using the Microscope.

The plan is carried out in cement and steel (see fig. 60). Below the

* For the loan of the blocks in this Plate we are indebted to the courtesy of the Royal Dublin Society.
† Rep. Exper. Stat. Com. Hawaian Sugar Planters' Assoc., 1905, pp. 39-59.

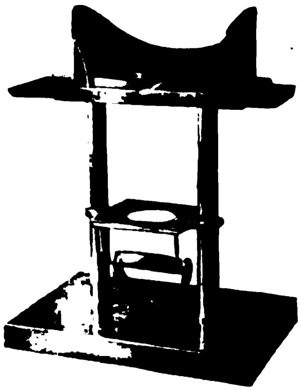

FIG. 1.

FIG. 2.

[To face p. 496.

building is a large block of cement weighing several tons. In this block of cement three T-girders, two of which are approximately 8 in. in each dimension, are imbedded vertically to the depth of about 4 ft. The central one of the girders carries the Microscope, together with certain accessory apparatus connected with the illumination of the object. This girder is much smaller and shorter than the other two, extending only about 18 in. above the floor of the Microscope room. The other two girders are mates and extend to within about 18 in. of the ceiling of the room; in other words, project upward into the room about 11 ft.

Needless to say, the object of these girders is to afford attachment for all the necessary apparatus connected with the Microscope. The girders at every part clear the walls of the building by a fair margin. It is, however, best to place all the girders as close to the Microscope window as is convenient. The reason for this will be explained on a subsequent page. In the present instance the distance between the girders and the window casings is about 1 in. The general principle on which the accessory apparatus is attached to the girders is that of sliding metal sleeves that may be clamped in any desired position. A sleeve of $\frac{1}{16}$ in. sheet metal surrounds the small central girder and projects outwards—that is, towards the observer—sufficiently to form a base on which the Microscope may rest. This base is from 1–2 times larger than the horse-shoe base of the Microscope. This gives a sufficient amount of space, so that the Microscope can be readily arranged for different classes of work, moved sidewise in either direction, or forwards or backwards. The sleeve carrying the Microscope is clamped to its pillar by 3 set-screws, and by means of this simple arrangement the Microscope can be raised and lowered to suit different operators and different classes of work. When, for instance, micro-photographs are being taken, it is most convenient to drop the sleeve to its lowest limit, so that the Microscope will rest on a base about 15 in. above the floor. For most photo-micrographic work this will enable the operator to bring the focusing plate of the camera (Fig. 60, *19*) low enough to render it unnecessary for the operator to have any special step-ladder to assist him in obtaining an accurate focus. On the other hand, when it is necessary to place the Microscope high and the camera-lucida table low, one can obtain a distance as great as $2\frac{1}{2}$ ft. between the level of the eye-piece of the Microscope and the drawing table. This, together with the peculiar camera-lucida, which will be described later on, enables one to make his original sketches of such a size as to allow for that liberal reduction in the subsequent photographic process which gives the best results for book illustrations. The sleeve which carries the Microscope also carries a wooden front as wide as the Microscope window and about 2 ft. deep —in other words, about 3 ft. by 2 ft. This screen, which of course slides up and down with the Microscope and its sleeve, carries two apertures. One of these apertures is in front of the Microscope mirror, and is designed to allow the light from the special out-door illuminating screen to strike the mirror and pass through the Microscope. The second aperture is of much larger size, and is glazed with ground glass and opened or closed as desired by means of a hanging slide worked by foot-power. The object of this second opening is to secure a correct

illumination on the drawing board when the camera-lucida is in use (see fig. 60, *32*, *36*).

We will next pass to a description of the Microscope window. This faces the sun, and preferably faces precisely south. It is so fitted with light-proof roller blinds that the light may be entirely shut off, or may be allowed full access. The roller blinds slide in lateral grooves 10 in. deep. The depth of these grooves must be sufficient to prevent the blinds bellying through the action of the wind. It is found when a window is tightly closed with flexible blinds, as is the case in this special Microscope window, that the pressure of the wind is sufficient to cause considerable inconvenience, unless the edges of these roller blinds are held in deep grooves. Should it be necessary to make a further provision against the bellying of the blinds, they may be stiffened from place to place with $\frac{1}{16}$ in. wooden laths; or wires may be strung across the window. The blinds may be of any opaque material, but if they

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EXPLANATION OF FIG. 60.

1, 1, 1, Pulleys for the sash cords 2; 2, 2, steel sash cords for the slides 12 and 21; 3, 3, two vertical steel girders passing through the floor without contact, imbedded in several tons of cement under the building; 4, 4, steel sash cords, same as 2; 5, wooden frame-work to stiffen the girders 3, 3; 6, 6, the two upper opaque sashes to the side windows of the bay; 7, 7, sash weights counterbalancing the cross-arms 12 and 21; 8, one of the two similar light-proof roller blinds; 9, 9, Anti-friction bearing for the arms bolted to the cross-piece 12; 10, anti-friction bearings for the arms of the cross-piece 21; 11, lower opaque wooden sash of the left hand window; 12, cross-piece for the attachment of the camera 18 and the camera lucida prism 24; 13, screw clamp to cross-piece 12; 14, lower opaque wooden sash to right hand bay window; 15, slot in which the camera lucida arm 17 slides horizontally; 16, clamp to the cross-arm 21; 17, arm for the support of the camera lucida prism 24: 18, ordinary camera attached to arm 12; 19, Microscope camera attached to arm 21; 20, vertically sliding head-rest; 21, wooden cross-arm supporting Microscope camera 19, and head-rest 20, and drop slide 32; 22, battery of Microscope, using direct sky-light; 23, screw clamp to cross-arm 21; 24, large 45° camera lucida prism; 25, location of the camera lucida drawing, vertically adjustable by means of steel cord and sash weights similar to 7; 26, pillow to head-rest; 27, wide thin metal curtain stick to the inside roller blind 8; 28, ways for the horizontal thin metal slide 29; 29, thin metal slide with diamond shaped opening 31; 30, small camera lucida prism of the usual pattern; 31, diamond-shaped opening in the slide 29; 32, thin opaque drop slide adjustable vertically through foot power, by means of simple pulleys located behind 17 and the foot power 40, 41, and 42; 33, left-hand adjustable leg-of-mutton shaped table; 34, right-hand adjustable leg-of-mutton shaped table; 35, opaque dark cloth enclosing sub-stage of Microscope, preventing access of extraneous light; 36, aperture for the admission of light, glazed with ground glass, and opened and closed by means of slide 32 and foot power 40, 41, and 42; 37, steel sleeve carrying Microscope, and vertically adjustable on the pillow 38; 38, steel pillar for support of Microscope, passing through floor without contact, and imbedded in several tons of cement under the building; 39, aperture in floor for the passage of girder 38; 40, spring-roller foot power for the control of drop slide 32 by means of the string passing around the pulley 42; 41, spring roller of ordinary pattern, covered with sand-paper to give sole of foot efficient grip; 42, pulley turned by foot power, and winding or unwinding the string which raises or lowers the drop slide 32—the weight of drop slide 32 exactly counteracts the spring of the roller 41; 43, left-hand steel girder at height of floor; 44, steel sleeve sliding vertically on left-hand girder and affording attachment for table 33; 45, steel sleeve sliding vertically on right-hand girder and affording attachment for table 34.

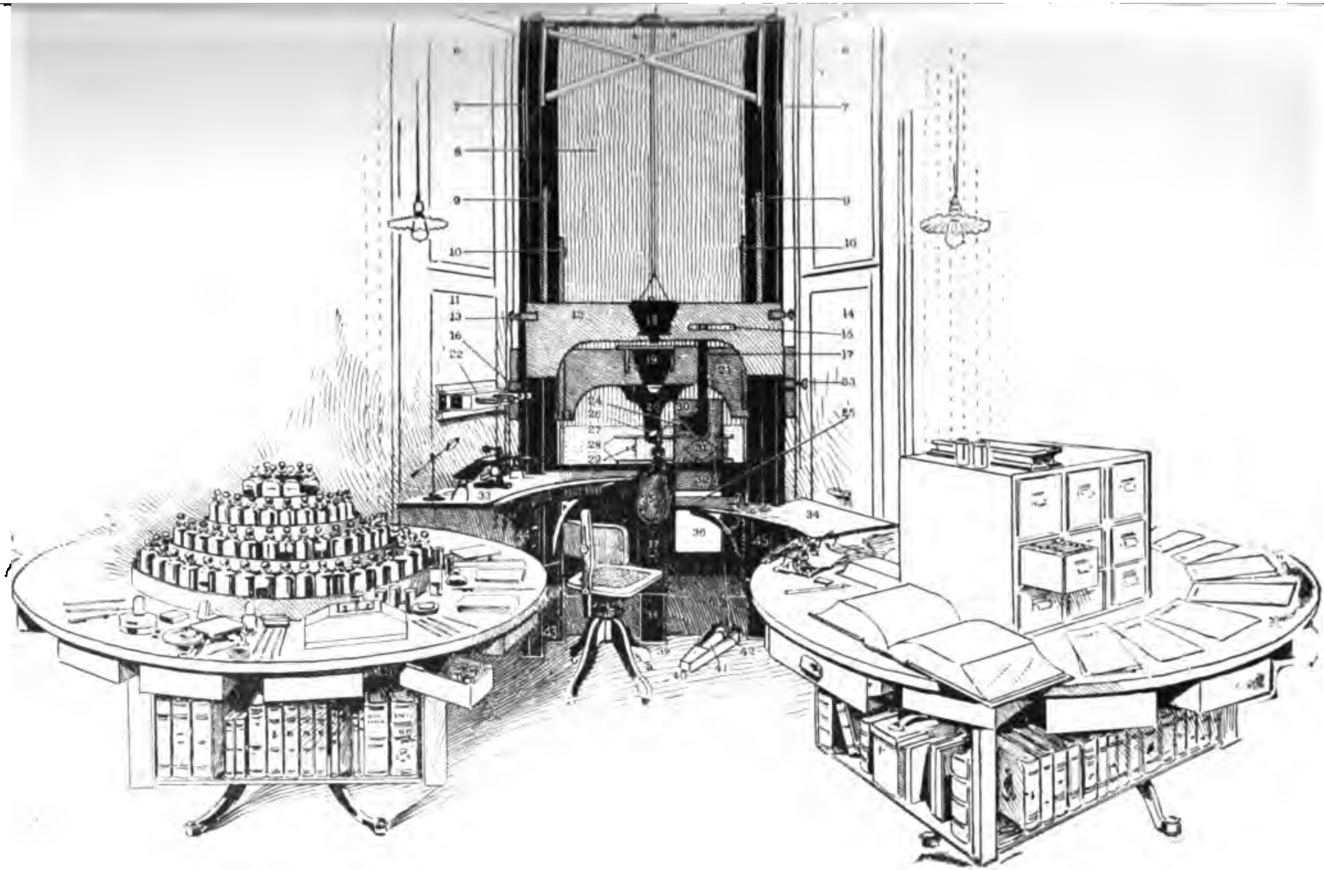

FIG. 60.

are very long, preferably of some thin material. The writer has found that ordinary green opaque window blinds can be sized black, so as to become practically light-proof, and as it is advisable in constructing a light trap to have two blinds, he finds that with two such blinds the light is wholly excluded, and, if necessary, the room can be used as a photographic dark-room. The wooden rollers used are of the ordinary pattern, and present no special peculiarity. They are built in, or boxed in, at the top in a light-tight manner.

We turn next to the various sleeves sliding on the long, upright girders. Of these one of the most important is the right-hand lower sleeve, which carries a leg-of-mutton shaped table for use in connection with the production of camera-lucida drawings. This sleeve, as well as all the others, is balanced with a sash-weight, so that it moves with the utmost freedom either up or down through a space of about 4 ft. The table may, therefore, be placed within 15 in. of the floor, or it may be raised to a distance of 3 ft. This adjustability is found to be highly convenient in the production of camera-lucida drawings of definite magnification. The peculiar shape of the table has been evolved from practical experience during many years. In general, its form is such that, when taken together with its mate on the other side of the Microscope, it presents a semicircular curvature, which gives the investigator a free play for hands and body. This table is painted black, as are all the other accessories used in this system (see fig. 60, *33*, *34*).

Turning to the left-hand side of the Microscope, we find an entirely similar and symmetrical sleeve and table, which, however, is used for a very different purpose. This sleeve carries the mate to the camera-lucida table, and, of course, in the case of a left-handed operator, could be used in the same way as the right-hand table would be used by a right-handed operator. The usual position for the left-hand table is about on a level with the Microscope stage. This height is found to be convenient for several reasons; first, under ordinary circumstances, it is about ordinary table height, and is convenient for supporting dissecting Microscope, which, as explained later on, has a special illumination of its own. Thus, in the preparation and examination of objects, the dissecting stand is as close as possible to the examination stand, and the objects may be transferred from one to the other with the greatest convenience; a second reason for having the left-hand table on a level with the stage of the Microscope, is that the preparations may be moved on and off the stage of the Microscope with the least danger and with the greatest facility. A third reason is that, in this position, the left forearm finds it a most convenient rest in working the fine-adjustment screw. In addition to the three sleeves already described, the long girders carry two cross-pieces for the attachment of various accessories. These wooden cross-pieces slide up and down, and are weighted with sash-weights, so that their adjustment may be quickly and easily accomplished. In order that the friction on the girders may not cause any inconvenience, arms extend upward from these cross-pieces for the purpose of carrying pulleys which are in contact with the edges of the girder, and so reduce the friction. These cross-pieccs are clamped in position by set-screws at the side. It will be at once evident that these

cross-pieces may be used for the attachment of a variety of accessories. Among the more important of these is the Microscope camera (see fig. 60, *19*). This hangs above the Microscope, and is ever in readiness for instant use. The camera itself presents no very peculiar features. It is, of course, a vertical pattern, carrying the exposed photographic plate in a horizontal position. It cannot be used in a horizontal position. Experience has shown that the vertical position has very many advantages, and that if one is confined to a single outfit, the vertical outfit is the better, providing its attachment can be of the nature here described. In obtaining the focus, the cross-piece carrying the camera is loosened by unclamping the side screws, and is then moved upward and downward against the sash-weights, which counterbalance it. A scale is marked on the girders, so that the various magnifications are at once obtainable, or they may be obtained by special measurement in each case. The apparatus never needs any levelling, being, as before said, constantly ready for use. The operator loosens two hooks, and the camera drops instantly into position. The whole is ready for use in a few seconds' time. If the photograph is being taken with a high power, and the illumination is, therefore, weak, and the exposure consequently long, one leaves his instrument during the exposure with the greatest confidence that nothing can disturb it. Any tremors in the building will not be received either by the Microscope or the photographic plate. A second attachment of great importance for the production of illustrations is the

CAMERA LUCIDA.

This presents a number of peculiarities (fig. 60, *17*, *24*).

Any form of camera-lucida is an instrument well calculated for the destruction of eyesight. The writer has during many years of experience been endeavouring to reduce the injury to the eyesight in connection with the use of the camera-lucida, and the following suggestions, embodied in the outfit here described, are the result of his experience. In the first place, he has substituted for the ordinary mirror a 45° prism (fig. 60, *24*). The advantages obtained by this substitution are as follows :—(1) The prism may be of any desired size, so that it may be mounted at a considerable distance from the eye-piece of the Microscope. This secures an increased magnification of the drawing, and the advisability of this increased magnification will be dwelt upon on a subsequent page ; (2) a second advantage in the use of the prism as a reflector is the disappearance of the double reflection, and the securing of a total reflection. The light passes from the drawing-point through the lower face of the prism in a nearly perpendicular direction, and with very little loss. It is then totally reflected from the oblique face, and passes outward at nearly right angles to the vertical face, again with very slight diminution. The loss of light is, therefore, considerably less than in the case of the usual mirror, in addition to the securing of a total reflection destitute of doubles ; (3) a third advantage, and one of considerable importance, is the stability of the apparatus here described ; it rarely gets out of register.

The second modification is the blind worked by foot-power (fig. 60, 32). The object of this blind is to illuminate the drawing with any degree of light at an instant's notice, and to do this without in any way disturbing the adjustment of any part of the Microscope or camera-lucida. This is a matter of very great importance in the rapid production of good camera-lucida drawings. It often happens that the light coming through the instrument is so faint that it is only by shutting the light quite off from the drawing that the investigator can see the details of the structures to be sketched. With the foot-power arrangement, the light is shut off or let on without the operator's disturbing the position of his body or his drawing-point. Moreover, the light can be so modified as to instantly bring about that adjustment which is most favourable for any particular part of the sketch. To describe the whole operation briefly, we may say that the operator's left hand rests on the left-hand leg-of-mutton table on a level with the fine adjustment of the Microscope. His left hand, therefore, is in a position to work the fine-adjustment screw with the greatest ease and facility, and the most careful adjustments of focus can be easily accomplished. His right hand, carrying the drawing-point, rests on the drawing-board, and is engaged in the production of the sketch. As the light required for the various portions of the drawing varies, he can, by a slight movement of his right foot, which in no way disturbs either of his hands, and in no way disturbs the equilibrium of the instruments, effect the desired illumination of the drawing. It is found that the drawing suface best adapted to the production of camera-lucida drawings, is a dark, and preferably black, surface. On this surface a white drawing-point should be used. For most objects this is a considerable improvement over the ordinary pencil used on white paper, as will be at once admitted by

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EXPLANATION OF FIG. 61.

Solar Camera, as used to facilitate the production of illustrations from negatives and from transparent objects.

1, steel girder to left of window affording part of the support to the ordinary camera 3; cross-piece supporting camera 3; 4, support for camera lucida, same being here represented as attached to an ordinary lens carrier; 5, vertically adjustible horizontal platform; 6, drawing board; 7, horizontal ways for 6; 8, object in position to be drawn natural size; 9, mirror of ordinary camera lucida; 10, 11, camera lucida support; 12, light-tight roller-blind used, when unrolled as a diaphragm for the cone of light from the projector; 13, solar projector set in special window casing near floor; 14, the negative being projected at 23; 15, 15, uprights carrying the adjustable sheet of glass on which the drawing 23 is being produced from the negative; 14, 16, wooden frame for sheet of glass 18; 17, metal braces by which the frame 16 may be clamped at the required angle; 18, sheet of glass through which, as well as through the paper 22, the image is viewed; 19, roller blinds to shut off extra light; 20, 21, sticks to which the drawing paper is attached with drawing tacks, these sticks being easily adjustable under the sand-paper-lined wooden spring-bars 24; 22, drawing paper; 23, image being drawn; 24, wooden bar lined with sandpaper and hinged at 25 and constantly pulled inward by a spiral spring at 26, so as to lightly but firmly grip the sticks 20, 21; 27, screw legs on which, after the apparatus has been adjusted, it can be raised so as to remain firm during the subsequent operations of focusing and drawing; 28, one of the four castors on which the whole apparatus is adjustable back and forward on the floor to vary the magnification.

Fig. 61.

anyone who makes a trial. The method found most effective in this laboratory is that of using a thin black tissue-paper, which is blued on the under side. A piece of enamelled board of suitable size for the drawing is placed on the drawing board—i.e. the right-hand leg-of-mutton table—and it is then covered with the black tissue-paper, with the blue side down. A tracing is now made with a white ivory point. This results in the production of a blue outline drawing on the enamelled board. This sketch is put aside for further reference, or for the production of a finished drawing whenever necessary, or may be finished up at once. The object to be secured in this blue sketch is a sufficiently good representation of the object to be illustrated, which shall have sufficient size to admit of a liberal reduction when the drawing is photographed on metal preparatory to etching. Thus, if it is desired to publish an illustration having a magnification of 500 diameters, it is advisable to produce a blue sketch at from 1000 to 2000 diameters. This is easily accomplished with the apparatus that has been described. By placing the prism reflector at a considerable horizontal distance from the eye-piece of the Microscope, say 1 foot, and lowering the right hand leg-of-mutton shaped table sufficiently, magnifications of liberal dimensions are easily secured. Needless to say, the production of a large coarse drawing is an easier matter than the production of the same drawing on a smaller scale ; so that the operation is not only better, but considerably easier if carried out in the manner described. It is unnecessary to go into the details of converting the blue sketch into a pen-and-ink drawing. These present no peculiarities. It ought, perhaps, to be mentioned that the object of using the blue colour is to avoid trouble through the alterations that may be necessary in finishing the drawing. Any light blue lines which are left on the enamelled board need not be removed, as they do not affect the sensitive photographic film sufficiently to cause any inconvenience in the production of an etched block. The black tissue-paper mentioned is produced by inking ordinary tissue. The ordinary blue carbon paper gives too dark a blue to meet the requirements. The blackened tissue is rubbed on one side with dry Prussian blue powder. This gives a light blue tracing.

At an earlier stage it has been mentioned that all the accessories in connection with the Microscope are painted black. In addition to this precaution, such arrangements are made that the room itself can be darkened, in fact, converted into a photographic dark-room at will. This object is secured by having all the window blind connections light-tight. The oblong aperture, about 5 in. by 8 in., through which the Microscope receives its light, is screened by means of several thicknesses of flexible black cloth made into the form of a sleeve. This cloth sleeve attached around the perimeter of the opening, is notched above, so that it surrounds the Microscope just beneath the stage, and buttons on to one of the screws at the back of the Microscope. No light reaches the eye except that which comes through the instrument. If, now, the slide in front of the large glazed aperture be closed and the room be darkened, the operator sits in absolute darkness. Any one who has had experience with a photographic dark-room, must have observed how, after a period of from five to ten minutes therein, the eye becomes accustomed to the

darkness of the room, and is able to distinguish objects much more readily than at first. This is a principle which can be utilised to very great advantage in connection with high-power Microscope work. In fact, the writer is of opinion that it is this contrast between the external and internal illumination which leads so many operators to use artificial light, and even in some cases to prefer working in the evening. Certain it is that if the surrounding light is dim, and the eye is allowed to adjust itself to this dimness, then on looking through the Microscope details may be seen much more clearly than in any other way. With the present apparatus the room is darkened. All light which could possibly get to the operator's eye is excluded, except that which comes through the Microscope. There is no light coming upon the top of his object to cause confusing reflections in the Microscope. The image is as clear as it can be made, and the eye is given every facility to see this image, and is distracted by no others. The following contrivances are such as experience has shown the writer to be very useful for this purpose, especially in sunny climates. Outside of the Microscope window a universally adjustable white screen is placed in a sunny position, preferably not more than 10 ft. away. The surface of this screen may be of any white material. It can be made of wood, painted white, or lined with plaster of Paris, or, what to the writer seems almost equally good, a plain wooden screen covered with several thicknesses of bleached cotton cloth. It is better if this screen can be adjusted from the interior of the Microscope room, but this is not essential. If a small mirror be attached to the screen, it will indicate the position of the screen that will reflect to the Microscope mirror a maximum of white light. Place the screen so that the flash of sunlight from the mirror strikes in the vicinity of the Microscope. Then, of course, the whole of the screen will be in a corresponding position, and will be reflecting a maximum of light. It is found that if the screen be placed in this position for several hours, the light from it remains practically constant, so that while an adjustment by cords from the interior is a convenience, it is not a very great necessity. If an adjustable screen is not available, it is generally best to arrange one or two fixed screens, and thus accomplish the same object—one screen for morning, and another for afternoon. The light from a blue sky is not a satisfactory light. A white cloud gives a very good light, but clouds are such fickle things that it is not wise to rely upon them where the Microscope is in constant use. It is much preferable to construct a screen that will be available in a fixed position whenever the sun shines. When the sun does not shine the sky must serve.

CAMERA LUCIDA FOR NATURAL SIZE OR REDUCED DRAWING.

Ever since the introduction of the camera lucida, it has been more or less used for the production of natural size and reduced drawings; in other words, it was soon seen that its application went beyond the instrument for which it was primarily designed. The writer has used the camera lucida to a greater or less extent in this manner for twenty-five years, and has seen plenty of evidence that others have

used it in the same way. The following notes relate to a piece of apparatus which has been gradually developed during several years, and which has as its object the application of the ordinary Microscope camera lucida to the purposes we have mentioned. It is a piece of apparatus which in use is placed in front of a window, in fact, is usually attached either to the window, the window casing, or to special uprights near by. As exemplified in this laboratory, the apparatus is attached to two upright girders, the same two that carry the ordinary photographic camera. Both these attachments are slung on sash weights, and can be moved up and down, so that either may be brought into play while the other is raised out of the way. The camera lucida attachment consists of two distinct frames, which are separated near the middle of the window by a distance of 8–10 in. The left-hand frame is designed mainly to support the camera lucida; the right-hand frame to support the drawing board. Both frames carry adjustable brackets, and each bracket carries a horizontal shelf. The left-hand frame, therefore, has a horizontal shelf carrying the Microscopes, and this shelf is adjustable in the vertical direction, and can be clamped in any desired position. In a similar manner, the right-hand frame carries a horizontal shelf, or drawing board, also adjustable in the vertical direction. The drawing board presents the peculiarity of being also adjustable in the horizontal direction, and of rotating about a horizontal axis so as to pass the opposite shelf—it is required sometimes above that shelf and sometimes below it. The size of the apparatus is determined by that of the human body. The greatest distance that can be comfortably reached by an ordinary artist for drawing purposes is about 30 in.—i.e. when gazing through the camera lucida he cannot comfortably produce a drawing at a distance of more than 30 in. from his eye as the light travels. The camera lucida is usually carried on a piece of tubing clamped

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EXPLANATION OF FIG. 62.

Sketch of the arrangement of a camera lucida for the production of drawings of objects at nearly the natural size. The apparatus is attached to upright steel girders, one at each side of a window. The artist faces the light.

1, 2, the two steel girders, which are imbedded in several tons of cement beneath the building, and pass through the floor without contact; 3, cross-piece to carry an ordinary camera 4, this cross-piece being hung on sash-weights, and sliding in the vertical direction and readily clamped by the side screws shown; 4, ordinary camera pushed up out of the way, but easily brought into use, as shown in fig. 60; 5, anti-friction arms of the cross-piece 3, which roll against the edges of the girders 1, 2; 6, left-hand box of roller blinds; 7, right-hand box of roller blinds; 8, light-tight vertically acting roller blind of the window; 9, 10, horizontally acting roller blinds from the boxes 6, 7; 11, object to be drawn, held in stage forceps; 12, mirror of ordinary camera-lucida; 13, horizontal stage, adjustable in the vertical direction, designed to support the object 11, which in this case is supported on the stage of a Microscope carrying no objective or eye-piece; 14, horizontal stage, adjustable in the vertical direction, designed to support the drawing board, which tips out to pass 13, and is also adjustable in the horizontal direction; 15, 16, framework supporting all the apparatus 6–14, and slung on sash-weights so as to be easily pushed up out of the way when the window is used for other purposes; 17, screw clamp to stage 14; 18, roller blind acting as a light trap and diaphragm when the window is used with the solar projector, as shown in fig. 61.

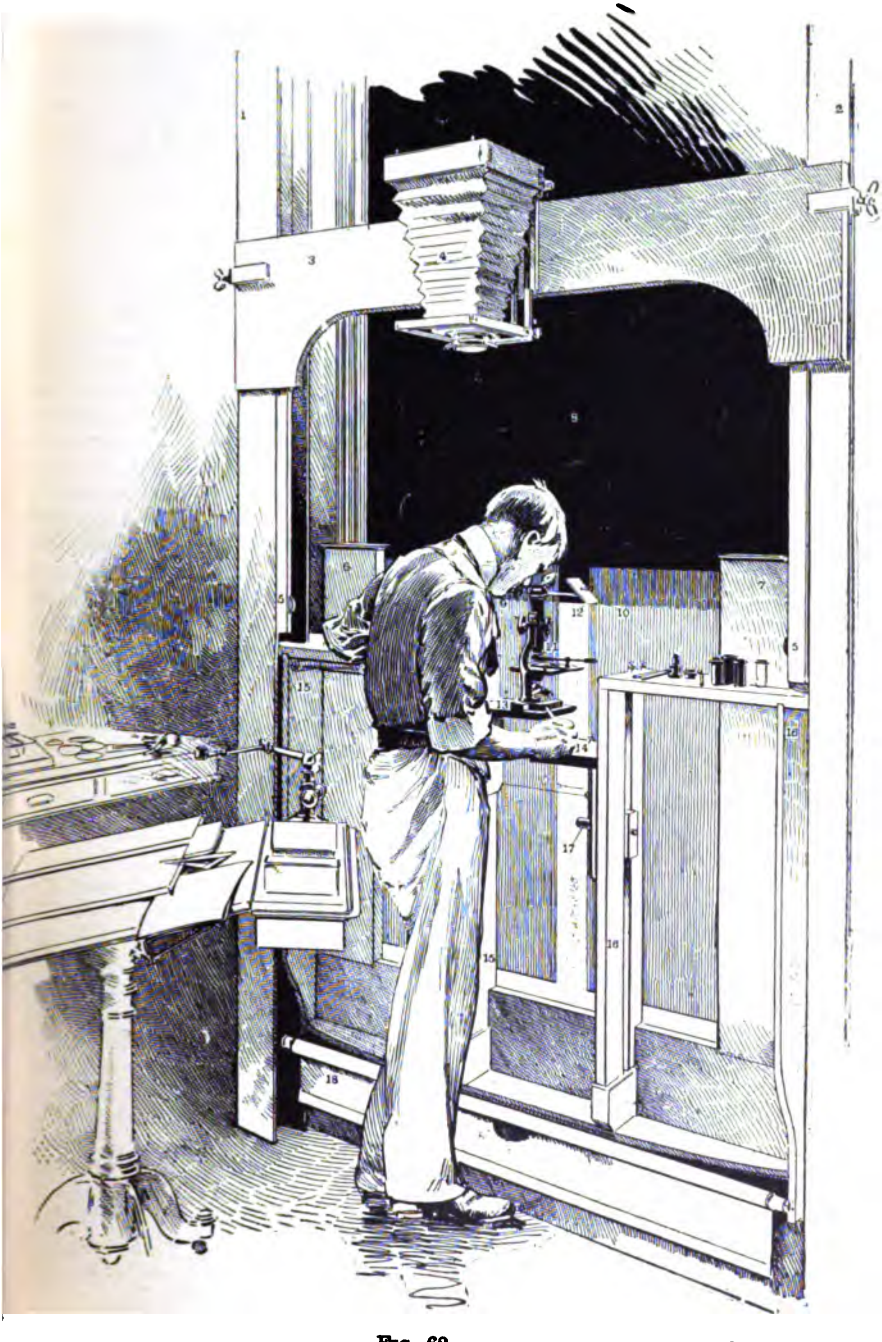

FIG. 62.

to an ordinary lens-holder, or empty Microscope barrel. The object to be drawn is placed below, without a lens, or with a reducing lens, or in some cases with a lens which slightly enlarges the object. The drawing board is then lowered or raised until the drawing to be made will have the necessary size. It will be observed, therefore, that the whole arrangement is a three-fold one. There is a support for the object, a support for the camera, and a support for the drawing board, and these must be adjustable within the limits of the artist's reach. It will be seen, however, that if two of these are adjustable, the whole system is, for all practical purposes, the same as if all three were adjustable. We now come to the most important matter in connection with the use of this apparatus—namely, the illumination of the object and the illumination of the drawing board. It is possible that it is in this respect that the apparatus hitherto put on the market fails to meet the requirements of the case. It is very desirable to fully control the illumination. Sometimes the object has to be strongly illuminated, and the drawing board weakly illuminated; sometimes the reverse is the case, the object has to be weakly illuminated, while the drawing board has to be very strongly illuminated, and the variation in illumination should be as great as possible—from strong sunlight to absolute darkness, if possible. This is the main point in the successful use of the camera lucida for this class of work. This object is attained in the present piece of apparatus by placing the whole at a sunny window and modifying the light by a series of seven roller blinds. One of these, and one of the most important, is the blind attached to the window itself. This does not differ from those elsewhere described in this report. The other blinds for this piece of apparatus have the peculiarity of working in the horizontal direction, the rollers being placed vertically side by side, and enclosed in a light-tight box at the side of the window. The box on the right carries three of these rollers, and that on the left carries a corresponding set of three. These blinds are of varying nature. One of each set is white, another is nearly translucent, and a third is somewhat opaque. By placing these blinds one over the other—that is, by adjusting them properly in the horizontal direction—the light may be varied in any degree required. No way has yet been found by which the light both upon the object and upon the drawing board can be fully controlled by foot-power, as in the case of the Microscope window previously described; but it is believed that if sufficient thought were given to the subject, such a device might be evolved. In the meantime, the present arrangement works fairly satisfactorily, and avoids the use of complicated apparatus between the eye and what it is looking at, in the same way as does the apparatus previously described in connection with the Microscope window.

Quekett Microscopical Club.—The 432nd ordinary meeting of the Club was held on June 15, the President, Dr. E. J. Spitta, F.R.M.S., etc., in the chair. Mr. A. E. Hilton read a paper "On the Study of the Mycetozoa." The names by which this group has been known were mentioned, and their distribution, habitat, and life-cycle, together with the method of classification, were described. The literature dealing

with the subject was referred to, and some useful hints were given for the collection and cultivation of these interesting organisms. The lecture was illustrated by a series of coloured drawings and a large number of preparations of Mycetozoa under Microscopes. Mr. J. Burton showed some active swarm-cells of *Brefeldia maxima*.

B. Technique.*

(1) Collecting Objects, including Culture Processes.

Cultivating and Preparing Hypotrichous Infusoria.†—L. L. Woodruff cultivated these organisms on slides, having a central circular concavity with a capacity of about 5 drops of water. Cover-glasses were not employed. The slides were kept in moist chambers to prevent evaporation of the preparations. These were dishes about 10 in. in diameter and 3 in. deep. In the bottom of the dish was placed about 2 in. of wet sand. Over the sand was placed a glass plate, on which rested 4 parallel strips of glass, and on these the slides with the Protozoa were arranged. The whole was covered with a ground-glass top. The Infusoria were handled with a pipette drawn out to a fine point; each pipette was used for one purpose, and one only. For detecting the Infusoria, a simple lens with a magnification of about ten diameters was used.

The culture medium was made from infusions of hay or fresh grass, and was prepared as follows:—about 3 grm. of grass or hay were washed in tap-water, and then placed in a beaker containing about 200 c.cm. of tap-water. This was boiled for 1 minute. In most cases the infusion was used shortly after it had cooled, but occasionally was allowed to stand for 24 hours.

One individual from each line of the culture was removed daily, in order to prevent the possibility of endogamous conjugation. The maximum and minimum temperatures of the laboratory in the vicinity of the culture were recorded daily.

For the purpose of following the changes in cell-structure during the life of the cultures, permanent preparations were made from time to time. The specimen to be preserved was isolated by means of a pipette, and deposited on a slide, and then 3 or 4 drops of a saturated solution of sublimate with 5 p.c. acetic acid added. After about 5 minutes the specimen was transferred to another slide, and a few drops of 75 p.c. alcohol deposited thereon. The specimen was next removed to a third slide already smeared with egg albumen. When the albumen has coagulated and fixed the specimen, the slide is transferred to agar of 75 p.c. alcohol, and afterwards treated by ordinary methods.

For staining, Ranvier's picrocarmin was used, though Delafield's

* This subdivision contains (1) Collecting Objects, including Culture Processes; (2) Preparing Objects; (3) Cutting, including Imbedding and Microtomes; (4) Staining and Injecting; (5) Mounting, including slides, preservative fluids, etc.; (6) Miscellaneous.

† Journ. Expér. Zool., ii. (1905) pp. 585–632 (3 pls.).

hæmatoxylin gave quite satisfactory results. The preparation was cleared with xylol, and mounted in dammar.

Rapid Filter for Agar.*—Drigalski uses the following form of filter for his agar media. It consists of two superposed cooking pots (fig. 63). The upper (F) has a perforated bottom; it overlaps the side of the lower vessel (U), and holds a 4-fold layer of yellow, unsized, raw cotton wool. In the lower vessel is placed the nutrient solution with agar. The two pots being fixed, the whole is placed in a steamer, where the agar is dissolved; the wool becomes saturated with steam, and, together with the upper vessel, is sterilised. When the solution is complete, usually within 3 hours, the whole is taken out from the steamer, the upper vessel with the filter is separated, and the contents of the lower vessel is poured into it, and in the course of a few minutes 3 litres of a clear solution are obtained.

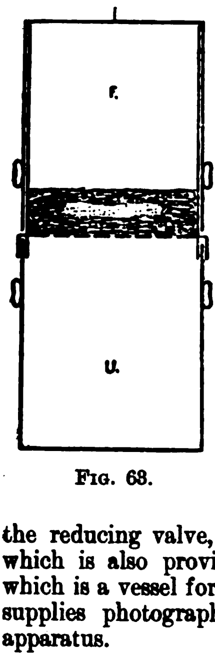

Fig. 63.

Apparatus for Culture of Bacteria at High Oxygen Pressure.†—A. Meyer's apparatus consists of a steel flask filled with compressed air, and fitted with a special reducing valve actuated by screws and levers, by which the pressure of the air emitted from the flask is varied and regulated; the pressures in the flask and in the reducing chamber being indicated by spring tube manometers. The compressed air is passed from the reducing valve, by a connecting tube, into the pressure chamber which is also provided with a manometer and a safety valve, and in which is a vessel for holding the cultures to be examined. The author supplies photographs and diagrams, and a minute description of his apparatus.

Method for the Bacteriological Examination of Soil.‡—Buhlert and Fickendey advocate a modification of Remy's method for the bacteriological examination of soil. With a clean spade a hole is dug the depth of a furrow, and with sharp cut perpendicular sides, and from this a spadeful of the soil is removed. The upper surface of this is cleansed by scraping with a flame-sterilised iron spatula; with a second sterilised spatula the earth is put into a sterilised glass vessel; 300–500 grm. of the soil are now added to 300–500 c.cm. of sterilised tap water in a glass vessel with a wide mouth and a ground stopper; after the mixture has been thoroughly shaken for five minutes, a known amount of the washed soil is drawn up in a pipette and inoculated into media. For nitrification and nitrogen fixing 20 c.cm. are employed; for denitrification and peptone disintegration, 5 c.cm.

* Centralbl. Bakt., 1te Abt. Orig., xli. (1906) p. 298 (1 fig.).
† Op. cit., 2te Abt., xvi. (1906) p. 386 (9 figs.).
‡ Tom. cit., p. 399.

Cultivation of the Leprosy Bacillus.*—C. Nicolle remarks that all his endeavours to cultivate *B. lepræ* on artificial media failed, though in some cases there was evidence that growth had begun. These abortive attempts invariably occurred in the condensation water, and only when the sowing had been copious. Egg cultures also were failures. The only occasions when there was distinct evidence of growth occurred on pieces of leprous tissue used for inoculating.

Cultivation of the Spirillum of Tick-fever.†—C. Levaditi makes collodion sacs with a capacity of about 2 c.cm., and sterilises them in tubes filled with distilled water. The sac, emptied of water, is still kept in the tube while being filled with serum of *Macacus cynomolgus* or *M. rhesus*, animals sensitive to the infection of tick-fever. The test-tube and sac are then placed in a water-bath at 70° for a quarter of an hour. When cold the serum is inoculated with defibrinated blood of a monkey previously infected with spirillosis, and when sealed up is placed within the peritoneal cavity of a rabbit or a rat. The sac is opened in from 5–7 days, and advantage is then taken to make a sub-culture.

In this way the spirillum of human relapsing fever may be cultivated in a semi-solid medium.

(2) Preparing Objects.

Studying Yellow Fever.‡—E. Marchoux and P. L. Simond fixed pieces of the viscera in Borrel's fluid (water 350, chloride of platinum 2, osmic acid, 2, chromic acid 2, acetic acid 20) or in saturated solution of acid sublimate. The nervous system was, however, fixed in equal parts of the two fluids, and after 3 days washed in running water for 54 hours. The stains used for pieces fixed in Birrel's fluid were magenta-red and picro-indigo-carmin. Unna's polychrome-methylen-blue also gave good results. Pieces fixed in sublimate were stained with hæmatein and orange G.

The authors confirm the statement of A. Sodre and M.Conto that yellow fever must be regarded as a generalised steatosis.

Studying Development of Pollen and Tapetal Cells in Ribes.§—G. Tischler fixed the buds with Flemming's fluid (chromic acid 1·8 grm., osmic acid 0·5 grm., acetic acid 12 c.cm., water 420 c.cm.). Paraffin sections 5–7·5 μ were made in the usual way. Staining was almost exclusively done with iron-alum-hæmatoxylin, and the differentiation of each preparation was controlled under the Microscope. The preparations were after-stained with light-green, or with acid-fuchsin.

Studying the Microscopical Anatomy of the Vagina and Uterus of Mammals.‖—K. Beiling fixed the fresh material in hot saturated sublimate-salt solution, or in 5 p.c. potassium bichromate, and then hardened in upgraded alcohols. Excess of sublimate was removed by

* Ann. Inst. Pasteur, xx. (1906) pp. 389–406 (1 pl.).
† Comptes Rendus, cxlii. (1906) pp. 1099–1100.
‡ Ann. Inst. Pasteur, xx. (1906) pp 161–205 (20 pls.).
§ Jahrb. wiss. Bot., xlii. (1906) pp. 545–78 (1 pl.).
‖ Archiv Mikrosk. Anat., lxvii. (1906) pp. 573–637 (1 pl.).

frequent changes of alcohol, to which tincture of iodine had been added. The material was then imbedded either in paraffin or in celloidin. For staining, Böhmer's hæmatoxylin and eosin, picrocarmin, or iron-alum-hæmatoxylin were used.

Demonstrating Chromosome Reduction in the Microsporocytes of Lilium tigrinum.*—J. H. Schaffner killed stamens of various ages in weak chrom-acetic acid (chromic acid 0·3 grm., glacial acetic acid 0·7 c.cm., water 99 c.cm.). The material was then passed through graded alcohols up to 70 p.c., imbedded in paraffin, cut to 10–18 μ thick, and stained on the slide. Delafield's hæmatoxylin was found to be the best stain for the chromatin network, and granules and saffranin-gentian-violet for the nucleoli.

Demonstrating the Development of Dentine.†—L. Fleischmann examined the tooth-germ of a lower middle incisor of an eight months' human embryo preserved in alcohol. The specimen was prepared by Schaffer's method, being decalcified for several hours in 5 p.c. nitric acid and then imbedded in celloidin; a radial longitudinal section exhibits the dentine in all stages of development, the earliest traces being at the bottom, whilst on the top is fully developed dentine. The sections are stained after the method of Zachariades with safranin and subsequent treatment with warm 40 p.c. solution of caustic potash, on the slide, until the ground substance is dissolved.

Studying the Organogenesis of Ovary and Testicle.‡—G. Sainmont used a complete series of embryos and ovaries of the cat. The animals were narcotised and then the uterus and adjacent parts were rapidly removed and placed in artificial serum previously heated to 37°. The embryos were then extracted and placed in the fixative; the larger were sliced into to allow more ready penetration. In embryos 40 days old or so the sexual eminences were removed and fixed separately. The fixative solutions used were the strong Flemming, 24–48 hours, and acetic-sublimate solution, 1–7 hours; after the latter the objects were washed in iodine-alcohol 40 p.c. for 4–8 hours and then passed through upgraded alcohols. Objects fixed in Flemming were submitted to prolonged washing in running water for from 8–36 hours according to size. After dehydration in up-graded alcohols paraffin sections were made. The stains used were iron-hæmatoxylin, Flemming's triple stain, and occasionallv gentian-violet used hot. It was found that embryos would require 4 or 5 times as much orange as was necessary for the young or adult animal. Good differentiation was obtained by washing the stained sections with alcohol acidulated with 2 or 3 drops of hydrochloric acid.

Studying Cytological Changes in the Nectar Glands of Vicia Faba.§—C. R. Stockhard cut the glands from the stipules with a border of non-glandular tissue and immersed in various fixatives, the most

* Bot. Gazette, xli. (1906) p. 184 (2 pls.).
† Arch. Mikrosk. Anat., lxviii. (1906) p. 297.
‡ Arch. Biol., xxii. (1905, published 1906) pp. 71–162 (6 pls.).
§ Bull. Torrey Bot. Club., xxxiii. (1906) pp. 247–62 (2 pls.).

satisfactory being Gilson's fluid, though picro-acetic, chrom-acetic, and picro-corrosive gave favourable results. Auerbach's methyl-green and acid-fuchsin stain was used for studying cell-contents. Heidenhain's iron-hæmatoxylin and Congo-red was found to be most valuable, and eosin-toluidin blue was also successful.

(4) Staining and Injecting.

New Microchemical Tests for Wood.*—V. Grafe adds to a solution of vanillin some drops of isobutyl-alcohol, and lets a little sulphuric acid (sp. gr. 1·84) run down the side of the test tube. After heating, the mixture turns dark-red, with a shade of blue. On diluting with alcohol and repeated additions of acid, it changes through blue-green to pale green. The author recommends as a standard reagent the following: 30 c.cm. isobutyl-alcohol plus 15 c.cm. sulphuric acid. When wood-mash is treated with this reagent the wood turns black; if now diluted with a little alcohol and the test tube be shaken, the wood turns blue or blue-green, while the fluid becomes red-violet. Sections of ligneous tissue treated with this fluid are at first red-violet and after a time blue. The sections should remain in the reagent for about an hour, and then be mounted in glycerin. Apparently the stain is not very permanent.

A mixture of isobutyl-aldehyd and sulphuric acid also forms a useful reagent. A drop of the mixture placed on a micro-section gradually turns it red, and if after the lapse of about an hour it be placed in glycerin it assumes a wine-red or red-violet hue.

Demonstrating Fat-Cells in Glandulæ Vesiculares of Cattle.†—G. Illing found that the best fixative for demonstrating the fat in the cells of the glandulæ vesiculares ‡ was Podwyssozki's fluid (1 p.c. chromic acid 15 c.cm., ½ p.c. sublimate 15 c.cm., 2 p.c. osmic acid 4 c.cm., acetic acid 6–8 drops). This showed the fat as black globules.

The special fat stains, Scharlach R, sudan iii, and indophenol, were also used. For Scharlach R the pieces were fixed for 24 hours in 10 p.c. formalin, and after having been washed in running water for some hours were sectioned with a freezing microtome. The sections having been washed first in water and then in 70 p.c. alcohol, were immersed for 2–3 minutes in Herxheimer's solution (absolute alcohol 70, 10 p.c. caustic soda 10, distilled water 10, Scharlach R. to saturation). The sections were then washed in 70 p.c. alcohol, and next after-stained with dilute aqueous hæmatoxylin solution, toluidin-blue, or methylen-blue. Having been washed with water, they were mounted in lævulose or in glycerin.

Studying the Connective-Tissue Framework in Lymphatic Glands.§—J. Bartel and R. Stein fixed the material in Zenker's fluid and made paraffin sections in the usual way. The sections were first stained with 0·1 p.c. aqueous acid fuchsin for 2–3 minutes. After washing in water they were immersed in a 1 p.c. solution of phospho-molybdic

* Oesterr. Botan. Zeitschr., lv. (1905) p. 174. See also Zeitschr. wiss. Mikrosk., xxii. (1905) pp. 581–2.

† See also this Journal, 1905, p. 683.

‡ Arch. Mikrosk. Anat., lxvi. (1905) pp. 121–7 (1 pl.).

§ Arch. Anat. Phys., 1905, pp. 141–58 (1 pl.).

acid for 5–7 minutes. They were then washed in water, and afterwards transferred to the following staining solution: anilin-blue 0·5 grm., orange G 0·2 grm., oxalic acid 2·0 grm., distilled water 100 c.cm. After 20 minutes or so the sections were washed quickly in water, dehydrated in alcohol, differentiated with a couple of drops of anilin oil, cleared up in xylol, and mounted in balsam.

Staining Capsules of Pneumococcus and Streptococcus.*—P. H. Hiss, jun., uses a half saturated aqueous solution of gentian-violet. Air-dried and heat-fixed films are stained for a few seconds with the solution. Water must not be used in making the films, but serum, or some similar fluid. After staining, the dye is washed off with 0·25 p.c. potassium carbonate solution, and the film examined in this fluid.

Another method is to treat the film with a 5 or 10 p.c. solution of gentian-violet or fuchsin (5 c.cm. saturated alcoholic solution to 95 c.cm. H_2O). Heat to vaporisation, and wash off with 20 p.c. solution of copper sulphate. Dry, and mount in balsam.

The author confirms the observations of Ortmann (1888) and others that pneumococcus regularly develops capsules when cultivated in blood serum. From his own experience he finds that one of the most favourable media for the development of capsules consists of 1 p.c. starch-bouillon and serum (serum 1 part, bouillon plus 1 p.c. starch 2 parts), and sterilised at 65°–70°.

Metallography, etc.

Influence of Velocity on the Law of Deformation of Metals.†—The pressures developed by explosives in guns are measured by the compression of small copper cylinders placed in crusher gauges. The accuracy of the measurement depends on the calculation of the pressure corresponding to a definite compression. The stress-strain relation for the cylinders is determined by submitting them to definite pressures applied much more slowly than under ballistic conditions, and measuring the compression. It has been established that the resistance of a rapidly compressed cylinder is greater than that of a cylinder slowly compressed to the same form. P. Vieille and R. Liouville point out that the resistance cannot be calculated from the amount and velocity of compression. Two cases are to be considered: (1) the measurement of maximum pressure; (2) the determination of the law of increase of pressure. The errors appear to be much greater for (2) than for (1). The authors promise an account of their work on the subject.

The Equilibrium Curves of the System Iron and Carbon.‡—H. v. Jüptner reviews the determinations of freezing point curves made by Mannesmann and Osmond, Roberts-Austen, Carpenter and Keeling, and Wüst. Selecting those points which appear to be the most trustworthy, the author has plotted a diagram showing the probable equi-

* Journ. Exper. Med., vi. (1905) pp. 317–45 (12 figs.).
† Comptes Rendus, cxlii. (1906) pp. 1057–8.
‡ Iron and Steel Mag., xi. (1906) pp. 377–82 (1 fig.).

librium curves. The end of the eutectic line lies at 2·07 p.c. carbon; the eutectic composition is 4·3 p.c. carbon. A calculation of the molecular weight of carbon dissolved in iron, based on Rothmund's equation

$$\Delta t = E\frac{c_1 - c_2}{m}$$

is given, but the results are doubtful owing to the uncertainty which exists as to the value of the latent heat of fusion of iron. Assuming it to be 20, the molecule of carbon dissolved in iron appears to contain 2 atoms.

An Etching Method.*—J. A. Aupperle points out that determinations of silicon and oxygen in steel, supposed to distinguish crucible steel from that made by other processes, cannot be relied on to do this. He has employed the following etching method: Specimens of the steel 1½ in. square are placed in dilute sulphuric acid containing permanganate of potash (90 c.cm. water, 10 c.cm. 1·84 s.g. acid, 3 grm. permanganate, for each specimen). The action is allowed to proceed over night; if the solution becomes coloured it is boiled until clear, more acid being added if necessary. The pieces are washed in water, and carbonaceous matter is wiped off. By this treatment open hearth and Bessemer steel are deeply etched in grooves: the edge is honeycombed and rough to the touch. Crucible steel is not etched in grooves but shows a close structure: the edges are smooth.

Solidification of Copper.†—P. Dejean has studied the freezing point of copper with the object of deciding as to its suitability as a fixed point for the calibration of thermo-couples. Platinum, platinum-iridium couples were used, standardised daily by determining the melting point of a small quantity of gold wire, this being taken as 1065°. Other fixed points taken were the boiling point of sulphur 445°, and the solidifying point of aluminium 655°. The cooling curves were photographically recorded, three galvanometers being used on the induction system previously described by the author.‡ About 100 grm. pure copper, deoxidised by hydrogen, was melted under wood charcoal, and a cooling curve taken. Similar determinations of freezing points were made on 10 samples containing varying quantities of oxide, which was subsequently estimated. Each of these samples gave two freezing points until the eutectic composition was reached. As a check, the solidifying points of several copper-aluminium alloys were determined. The results given by the author are:—

Freezing point pure copper, 1085°.
Freezing point eutectic (copper, copper oxide), 1065°.
Composition of eutectic, 4·5–5·0 p.c. oxide.

The freezing point of the eutectic is somewhat lower when it is present only in small quantities. Its composition was verified by microscopic examination. The lower freezing point of copper containing 2–3 p.c.

* Iron and Steel Mag., xi. (1906) pp. 383–5 (2 figs.).
† Rev. Metallurgie, iii. (1906) pp. 233–42 (10 figs.).
‡ See this Journal, 1905, p. 777.

oxide, prepared by melting copper in an open crucible so that it oxidises freely, is recommended as a fixed point for calibrating thermocouples, and may be taken as 1062°.

Rail Corrugation.*—G. Moyle discusses the singular phenomenon of roaring rails, i.e. rails which in use develop furrows across the running head, causing a deafening noise when a train passes over. The ascertained facts are briefly stated, and a list is given of the numerous causes suggested. A report on three "roarers," drawn up at the Cooper's Hill laboratory, states that the unevenness of surface is not due to the chemical composition or physical state of the rail but to some local cause. The author considers that the results of investigation are meagre and unsatisfactory. Microscopic examination appears to throw no light on the cause.

Copper Steels.†—P. Breuil has investigated two series of steels containing copper, the carbon in the first being about 0·15 p.c., in the second about 0·35 p.c. The copper in the members of each series was 0·5, 1, 2, 4, 8, 16 and 32 p.c. Analyses of the top and bottom of the ingots showed that the copper was uniformly distributed, except in the ingot of the second series containing 32 p.c. copper. This practically consisted of two portions. The copper content varied from 21–75 p.c. The fractures of the ingots with 8 p.c. or more of copper showed a red coloration. The hardness of the steels increased with increase in copper content. Peculiarities in the position of the critical points were noted.

The Crystallography of Iron.‡—F. Osmond and G. Cartaud put forward an explanation of the structure of martensite. When a small piece of ordinary steel containing manganese is quenched from about 1100° in cold water, cracks may be developed. Around the cracks are very fine twin crystals. The microstructure of a polished section is exactly similar to that of martensite in carbon steels. The partial transformation of γ iron into β iron occurring during quenching produces stresses, owing to change of volume. These stresses cause the formation of twin crystals in great numbers, parallel in any one grain to the four pairs of faces of the octahedron; whence the frequency of square figures and equilateral triangles. The marked resemblance between the structures of martensite and of meteoric iron is pointed out.

Critical Points of Steel.§—P. Fournel has succeeded in detecting A_1 and A_2 as well as A_3 by the variation of electrical resistance of steel with temperature. Wires 0·3 mm. diam. 30 cm. long were wound on mica and heated *in vacuo* in an electric resistance furnace. In series with the wire was a standard 1-ohm resistance; a current of a few hundredths of an ampere was passed through, and the difference of potential between the two ends of the wire, and of the two ends of the standard resistance, measured by a potentiometer. Temperatures were measured by a thermocouple. Figures and curves for five steels are given by the author.

* Tramway and Railway World, xix. (1906) pp. 558–61 (9 figs.).
† Comptes Rendus, cxlii. (1906) pp. 1421–4.
‡ Op. cit., cxliii. (1906) pp. 44–6. § Tom. cit., pp. 46–9 (1 fig.).

Aluminium Zinc Alloys.*—E. S. Shepherd determined the densities of 11 alloys of aluminium and zinc, and from the form of the specific volume curve concluded that the phases present were approximately pure zinc, and a solid solution of zinc in aluminium with a limiting concentration of about 50 p.c. Cooling curves of the alloys containing 60 and 50 p.c. aluminium did not indicate any evolution of heat at the solidifying point of the eutectic, while the 50 p.c. alloy gave an evolution of heat. Alloys with more than 60 p.c. aluminium are microscopically homogeneous. At 60 p.c. some intercrystalline material is present: this disappears on annealing. A true eutectic is present in the 40 p.c. alloy. The author holds that the pyrometric and microscopic data are in perfect agreement with the deductions based on the specific volume relations. This series of alloys presents no definite compounds; there are two solid solutions, zinc in aluminium (maximum 50 p.c.) and aluminium in zinc (4 p.c.), which form a eutectic containing about 5 p.c. aluminium.

ANON.—**Metallurgical Research at the National Physical Laboratory.** *Engineering Times*, 1906, p. 218.

„ **Rusting of Iron.**
[A brief account of the theories of Dunstan, Moody, and others, as to the chemical reactions which take place when rust forms on iron.] *Nature*, lxxiv. (1906) pp. 116–17.

ARNOLD, J. O.—**The Internal Architecture of Metals.** *Engineering*, 1906, pp. 278–9.

ANDREWS, T.—**Microscopic Observations on Naval Accidents.** *Tom. cit.*, pp. 331–2.

BACH, C.—**Strength of Mild and Cast Steel at High Temperatures.** *Tom. cit.*, pp. 401–4 (7 figs.).

DIXON, E.—**Nickel and Carbon Steels.** *Tom. cit.*, pp. 22–3.

HADFIELD, R. A.—**Unsolved Problems in Metallurgy.** *Engineering Times*, 1906, p. 312.

LONGMUIR, P.—**Manganese Bronze.**
[Describes the properties of a number of alloys, and points out that iron, aluminium, and manganese each have the effect of raising the tenacity of copper-zinc alloys (brasses). High casting temperature has an injurious effect upon manganese bronze.] *Foundry*, xxvi. (1905) pp. 116–18.

OLSEN, T. Y.—**Fragility of Iron and Steel.**
[The Frémont method of determining brittleness is described, with full details of the construction of the machine, and a discussion of the advantages offered by the impact test.] *Tom. cit.*, pp. 125–33 (8 figs.).

PEAKE, A. H.—**A Novel Instrument for Illustrating the Magnetic Properties of Iron.** *Proc. Camb. Phil. Soc.*, xiii. (1906) pp. 250–7 (7 figs.).

SMITH, J. K.—**Vanadium and its Services to Steel Manufacture.** *Engineering Times*, 1906, p. 218.

STEINHART, O. J.—**Notes on Metals and their Ferro-Alloys used in the Manufacture of Alloy Steels.** *Iron and Steel Mag.*, xi. (1906) pp. 394–400.

* Journ. Phys. Chem. x. (1906) pp. 504–12 (2 figs. and 5 photomicrographs).

PROCEEDINGS OF THE SOCIETY.

MEETING

HELD ON THE 20TH OF JUNE, 1906, AT 20 HANOVER SQUARE, W., DR. D. H. SCOTT, F.R.S., ETC., PRESIDENT, IN THE CHAIR.

The Minutes of the Meeting of the 16th of May, 1906, were read and confirmed, and were signed by the President.

Mr. J. T. Holder exhibited and described an old Microscope made by Andrew Pritchard for Mr. T. M. Ray in 1846, which had been lent for exhibition by Mr. W. R. Reeves, of Liverpool. In addition to the set of objectives and apparatus described by Mr. Holder in his paper, there was a candle-holder fixed to one side, also invented by Pritchard.

The thanks of the Meeting were voted to Mr. Holder for his paper, and to Mr. Reeves for sending this Microscope for exhibition.

Dr. Hebb read a letter which had been received from Mr. Dollman, of Adelaide, Australia, with reference to his recent communication on Stereoscopic Photomicrography. The letter stated that since writing his paper, he had succeeded in making some photographs of objects under high powers, examples of which were exhibited in the room.

The thanks of the Meeting were voted to Mr. Dollman for his letter and exhibit, and to Dr. Hebb for bringing them before the Meeting.

Mr. Rheinberg's paper "On the Influence on Images of Gratings of Phase Differences amongst their Spectra," was taken as read.

Dr. D. H. Scott read a paper "On the Structure of some Carboniferous Ferns." He began by pointing out the revolutionary change which had taken place during the last three years in our conception of the Carboniferous Ferns. Representatives of so many of the principal Fern-like genera were now either known to have borne seeds, or were under strong suspicion of the seed-bearing habit, that comparatively few undoubted Ferns were left, and the question had even been suggested whether, at least in the Lower Carboniferous, true Ferns existed. The problem was of the utmost importance with reference both to the history of the Ferns themselves and to the probable ancestry of the Pteridosperms and Seed-plants generally.

There was one family, the Botryopterideæ, which was generally

admitted to be an ancient group of Ferns, well represented in Lower as well as Upper Carboniferous times, and not at present betraying any symptoms of Spermophytic affinities. The family was chiefly known from structural specimens, very few impressions, showing the habit, having been as yet referred to it.

Mr. Newell Arber, in a recent discussion at the Linnean Society,* proposed to establish a group Primofilices to include the Botryopterideæ and other primitive Ferns of Palæozoic age. The object of the present communication was to give a few illustrations of this ancient race of Ferns, to which Professor Lignier had also called attention.†

The Botryopterideæ proper were first described, beginning with the type genus *Botrypteris*, now represented by at least two British species in addition to the French form on which Renault founded the genus. Fructifications probably referable to the English species were shown, the multiseriate annulus being a characteristic feature of the genus.

The genus *Zygopteris* was next considered, and attention called to the presence of central tracheides internal to the main ring of wood; besides Renault's species, the British representatives *Z. Grayi* and *Z. corrugata* were described; the former showing axillary branching, as in the recent Hymenophyllaceæ, while in *Z. corrugata* the ramification was found to be rather of the nature of a dichotomy. The structure of the scale-leaves, or aphlebiæ, described by Renault and Stenzel in Continental species, was demonstrated for the first time in a British form, *Z. corrugata*.‡ Sporangia with a very broad annulus were described, which might probably belong to species of *Zygopteris*, though it was not yet possible to compare them in detail with the well-known fructifications discovered by Renault.

A new genus from the Lower Coal-Measures of Lancashire was then described, remarkable for possessing radially seriated wood, apparently of a secondary character. In other respects the structure had much in common with that of *Zygopteris corrugata*, the new genus, for which the name *Botrychioxylon* was proposed, being related anatomically to *Zygopteris* somewhat as *Botrychium* to *Ophioglossum* among recent Ferns. This was the first time that evidence of secondary growth in thickness had been obtained among the Botryopterideæ.

After two or three other examples of this family had been given, Dr. Scott described certain annulate Fern-sporangia,§ borne on the pinnules of a Sphenopteroid lamina, which were not uncommon in the calcareous nodules of the British Lower Coal-Measures. In some aspects the appearance of these sporangia was wonderfully Polypodiaceous, but transverse sections of the annulus showed that it was two cells in breadth. There was nothing to connect this fructification immediately with the Botryopterideæ, but it might be placed provisionally within the broader limits of Mr. Arber's Primofilices.

An instance of spores caught in the act of germination within a

* See New Phytologist, April 1906.

† Equisétales et Sphénophyllales. Leur Origine filicinéene commune. Bull. Soc. Linn. de Normandie, 1903.

‡ They were also present in *Zygopteris Grayi*, contrary to the opinions expressed in the author's Studies in Fossil Botany, p. 284.

§ Since named *Pteridotheca Williamsoni*.

sporangium like that of a Fern had been previously described,* and was again demonstrated. Until now it had not been possible to identify the sporangium in question, but within the last few weeks similar stages of germination had been observed within a sporangium certainly belonging to *Stauropteris oldhamia*.† It was probable, from the structure of the former sporangium, that it too was referable to a species of *Stauropteris*. As the phenomena of germination in these cases were entirely similar to those in recent Ferns, it appeared to be established that the genus *Stauropteris* belonged to the Ferns and not to the Pteridosperms, a question previously left open. There was a certain affinity with Botryopterideæ, but the characters of the exannulate sporangia differed from those of other fructifications of this family.

Dr. Scott desired to acknowledge the help which he had received from his wife, Mrs. D. H. Scott, F.L.S., in the detection of these fossil germinating spores.

The paper was illustrated by fossil and recent sections, thrown on the screen by means of the epidiascope, as well as by lantern slides.

Mr. Karop said it would no doubt be their pleasure to return a very hearty vote of thanks to the President for his very interesting and instructive address on a subject of which he was *facile princeps*.

The motion, being put to the Meeting, was carried unanimously.

The President, in responding, said that he was greatly obliged to the Fellows present, not only for their vote of thanks, but for the kind way in which they had received a communication which, to those who were not botanists, must have seemed very technical.

It was announced that the rooms of the Society would be closed from August 17 to September 17, and that the next Meeting would take place on October 17, when the following papers would be read: "New Indian Rotifers," by Mr. James Murray, and "*Cornuvia serpula*: a Species of Mycetozoa new to Britain," by Mr. J. M. Coon.

The following Instruments, Objects, etc., were exhibited:—

Dr. Hebb:—High-power Stereo-photomicrographs, taken by Mr. W. P. Dollman.

Mr. J. T. Holder:—An Old Microscope, by Pritchard, lent for exhibition by Mr. W. R. Reeves.

The President:—Recent and Fossil Sections and Lantern Slides, shown on the screen, in illustration of his paper.

New Fellow.—Mr. William Charles Greaves was balloted for and elected an *Ordinary* Fellow of the Society.

* Scott, Germinating Spores in a fossil Fern-Sporangium, New Phytolog., iii. (1904).

† Cf. Scott, Sporangia of *Stauropteris Oldhamia*, New Phytolog., iv. (1904).

JOURNAL

OF THE

ROYAL MICROSCOPICAL SOCIETY.

OCTOBER, 1906.

TRANSACTIONS OF THE SOCIETY.

X.—*On the Limits of Resolving Power for the Microscope and Telescope.*

By Edward M. Nelson.

(*Read March 21st*, 1906.)

It cannot be admitted that the theoretical resolving limits, both for the telescope and the microscope, are as satisfactory as the science of to-day requires. As the telescope and the microscope are mere variations of the same optical instrument, the theoretical resolving limits should be the same for both. Few, however, will recognise the identity of the telescope limit of $\frac{4''\cdot 56}{\text{aperture in inches}}$ with the column at the end of our Journal headed "Limit of Resolving Power in Lines to an Inch for White Light." To make this subject at all intelligible to microscopical readers, it will be necessary to trace, very briefly, the position of the telescope limit, and we may well take this first, as its investigation predates that of the microscope by some forty years.

A point of light, such as a star, is imaged both in a telescope and in a microscope as a bright disk surrounded by alternate dark and bright rings. It has been the received opinion that the radius of the first dark ring is the measure of the limit for the separation of a double star by a telescope, so that it is this radius which must for the present occupy our attention. The method of calculating this radius, when the aperture of the telescope is square, is quite simple, but it will suffice for our present purpose to accept the result, and refer the reader to text-books for the proof. It has been found that, when the aperture is square, the radius of the first

dark ring subtends the same angle at the centre of the object-glass, as a single wave-length does at a distance equal to the length of a side of the square aperture of the object-glass.

The length of the radius of the first dark ring in a telescope is determined by the formula $\frac{c\lambda f}{a}$, where c is a coefficient, λ the wave-length, f the focus, and a the aperture of the object-glass. The value of λ for white light will, throughout this paper, be that suggested by Mr. J. W. Gifford, viz. $\frac{1}{45287}$ inch = 5607 tenth metres.

As the radius of the first dark ring subtends an angle at the centre of the object-glass of $\frac{c\lambda}{a}$, and as the limit for the resolving power of a telescope is required in this angular measurement, the quantity f may for the present be disregarded. Lastly, we come to the coefficient c; the experimental determination of this quantity, both for the telescope and for the microscope, is the subject with which we are concerned this evening. When the aperture is square, the value of c is unity, and so the formula just given above may be written $\frac{\lambda}{a}$, which expressed as an angle is $4''\cdot 55$. Theoretically, then, a telescope, with a *square* aperture, will separate any double star whose components subtend an angle of $4''\cdot 55$ divided by the aperture of the telescope in inches. Now, as the object-glasses of telescopes are circular, and not square, mathematicians have integrated this quantity for a *circular* aperture, and have found the value of c to be $1\cdot 2197$; therefore the theoretical separating limit for a circular aperture, when expressed as an angle, is $5''\cdot 55$, or one second more than that for a square aperture.

We now come to the unsatisfactory part of the subject, viz. the *practical* separating limit for a telescope with a *circular* aperture is the same as the *theoretical* limit for one with a *square* aperture. In other words, the theoretical limit is 18 per cent. greater than it ought to be! The theorists say that the quantity determined is the radius of the first dark ring, which may not necessarily be the separating limit. This is true, but if the radius of the first dark ring be experimentally determined, it will be found to be 32 p.c. smaller than its theoretical value. What would be thought of the Newtonian theory of gravitation if the calculated distance of Mars from the Sun was 32 p.c. too great? The theoretical value of c for the measurement of the first dark ring with a telescope having a circular aperture is, as stated above, $1\cdot 2197$, whilst the value as experimentally determined is $0\cdot 8266$, or 32 p.c. less.

The empirical formula for the telescope limit employed by a most expert double star observer, the late Rev. W. R. Dawes,

Dean of Hereford, was $\frac{4''\cdot 56}{a}$, this being the *theoretical* limit for a telescope with a *square* aperture, and this is the limit which practical astronomers still use.*

The star known as ϵ_1 Lyræ was examined, and widely separated, by a telescope of 1·575 in. aperture; the mean distance of the components, as lately determined by three different observers, is 3″·045. The value of c in this instance is therefore 1·053, or in angular measure it is $\frac{4''\cdot 796}{a}$, a result not differing greatly from that used by Dawes. The same telescope refused to separate the components of ϵ_2 Lyræ, which are 2″·28 apart. Here the value of c is 0·7884, and the angle is $\frac{3''\cdot 591}{a}$. The true telescopic limit lies, therefore, between these two results, and probably nearer the first.

Lord Rayleigh, experimenting with a *rectangular* aperture and a grating, obtained 1·0923 for the value of c; the greatest distance the grating was removed from the telescope was 196 in.

The author's experiments with *circular* apertures and gratings, at distances varying from 90 to 700 yards, gave for c the slightly smaller value of 1·0649. Lastly, we have Rayleigh's theoretical limit for the visibility of a dark bar upon a light ground, which gives c a value of 0·125; its value as practically measured appears to be 0·42.

The theoretical value of c for the length of the radius of the first bright ring is 1·63; its value, however, as practically determined in a microscope, is 1·16, or 29 p.c. less. It will be remembered that the difference between the theoretical and practical measurements of the radius of the first dark ring with a telescope amounted to 32 p.c., and now we have a very similar difference between theory and practice in a measurement by a microscope.

The theoretical length of the radius of the first dark ring in a microscope may be determined from the telescope formula $\frac{c\lambda f}{a}$ by writing for the diameter of the telescope objective, a, its microscopical equivalent, viz. 2 N.A. f, where N.A. stands, as usual, for the Numerical Aperture. The quantity f must now be restored to the formula, because the microscopical limit deals with linear measurements, and not with angular quantities. So the standard formula for the telescope, $\frac{c\lambda f}{a}$, becomes $\frac{c\lambda}{2\text{ N.A}}$.

As we shall be dealing with a resolving limit expressed in "lines to the inch," the reciprocal of this quantity will be re-

* The Dean used a slightly larger wave-length; this makes the quantity 4″·56 instead of 4″·55, as above.

quired, and a further simplification may be effected by writing κ for the reciprocal of λ. The telescopic formula $\frac{c\lambda f}{a}$ is therefore expressed by its microscopic equivalent $\frac{2\,\text{N.A.}\,\kappa}{c}$ (the numerical value of κ being 45,287). If now c be made equal to unity, for a square aperture, 2 N.A. κ is precisely identical with the formula of Professor Abbe, based upon his spectrum theory, the numerical value of which is given in the "Table of Resolving Limits" at the end of our Journal (see No. 5 in the following table).

So long as the investigation proceeds upon the lines of the spectrum theory, it matters not an iota whether the objective be square or round (both in the telescope and microscope with a square aperture the line of separation must be placed parallel to a side of the square), for that table of microscopical limits only holds good when an objective is illuminated by a narrow pencil of extreme obliquity, and only a small portion at the opposite ends of a diameter of an object-glass is utilised—under which conditions the resultant limit must be the same whether an objective is square or round, and to integrate the action of interference over the circular aperture would be labour wasted.

An astronomer is consistent, for he says that the theoretical limit for his telescope is so much, but that if it had a square aperture, theory points out that it would be able to show him still finer detail in an object; but, for some unexplained reason, his telescope with a circular aperture does in practice show him the detail theory assigns to a square aperture. An Abbe theorist, on the other hand, is wholly inconsistent, for he contends that, although the aperture of his objective is circular, the theoretical limit for its resolving power must be that for a square aperture.

The experimental results and the theoretical values detailed above are arranged in the following synoptic table, where each telescopic experiment has its microscopic equivalent adjoined, and *vice versâ*. The telescope limit is given in seconds, which must be divided by the aperture of the object-glass in inches. The microscope limit is given in the "number of lines to the inch" that an objective of N.A. 1·0 will resolve with a full cone, and with white light; to adapt it to any other objective whose N.A. differs from unity, it must be multiplied by the N.A. of that objective.

The experiments with artificial double stars did not prove satisfactory until the holes, which were 0·01 in. in diameter, were removed to at least 200 yards from the telescope, so that the holes themselves should subtend very small angles. The first dark ring No. 2 was measured by removing an artificial double star from a telescope until the dark rings made contact; the distance of the telescope from the star was then measured, and the separation of the

stars being known, the angle was found. The bright ring No. 4 was measured by a microscope with a screw micrometer. With reference to Nos. 6 and 7, the telescope would doubtless divide a 2″·85 star, indicating a 4″·5 limit, and an unsuccessful search was made for one upon which to experiment. Late measurements of ϵ_1 and ϵ_2 Lyræ were kindly supplied by Mr. Lewis, of Greenwich. No. 13 was very difficult to measure, and the value

	c	Telescope* $\frac{c\lambda}{a}$	Microscope† $\frac{2\,\text{N.A.}\,\kappa}{c}$
1. Radius, first dark ring for circular aperture (Airy theory)	1·2197	5″·555	74,900
2. Radius, first dark ring for circular aperture, as measured	0·8266	3″·765	110,000
3. Radius, first bright ring for circular aperture (Airy theory)	1·63	7″·42	55,600
4. Radius, first bright ring for circular aperture, as measured	1·1597	5″·282	78,100
5. Dawes' empirical limit = theoretical for a square aperture = Abbe's table (at the end of the Journal) . . .	1·0000	4″·555	90,574
6. ϵ_1 Lyræ, when easily separated (circular aperture 1·575 in.)	1·053	4″·796	86,000
7. ϵ_2 Lyræ, not separated . . (circular aperture 1·575 in.)	0·7884	3″·591	115,000
8. Artificial double stars at 900 yds. distance, circular aperture	0·9957	4″·535	91,000
9. Rayleigh's experiments with gratings and rectangular aperture, greatest distance 196 in. Mean value	1·0923	4″·975	82,900
10. Author's experiments with gratings and circular aperture at 90 to 700 yards. Mean value	1·0649	4″·85	85,100
11. Rayleigh's theoretical limit for dark bar on bright ground	0·125	0″·569	725,000
12. Mean value for dark bar, measured by circular aperture at 900 yards . .	0·42	1″·913	216,000
13. Mean value for dark bar, measured by a microscope	0·3713	1″·691	244,000
14. Maximum number of lines resolved by Mr. A. A. C. Merlin	1·0952	4″·988	82,700
15. Value adopted in Table of "Working Limits"	1·3000	5″·921	69,672

* Angular subtense of interval separated by 1 in. of aperture.
† Number of lines resolved by an objective of N.A. 1·0 with white light and full cone.

here given is probably a little too small. It is important to microscopists, because it forms the basis for the correction for antipoint in micrometrical measurements.‡

‡ Should any one wish to experiment further in this direction, the following formulæ will be useful: To find the value of c from an angle, multiply the number of seconds by 0·21956; to reduce c to an angle, multiply c by 4·5546; to find the value of c from the number of lines resolved, divide 90574 by the number of lines, and conversely to find the number of lines resolved from c, divide 90574 by c.

We now come to the experiments which are of primary importance to microscopists. No. 14 is an example of what can be done with keen vision, the best lenses and apparatus, and expert manipulation. Mr. Merlin has resolved the *Amphipleura pellucida* with a long tube apochromatic $\frac{1}{6}$ of 0·98 N.A., and with a full cone from an apochromatic condenser, using a Gifford's F line-screen. His mean result with several objectives gives c a value of 1·187, an angle of 5″·41, and 76,300 lines to an inch. This last value and that in No. 14 are for white light; they have been deduced from results kindly given by Mr. Merlin, and obtained by him with a Gifford's screen. These are exceptionally high results, which cannot be approached by the ordinary microscopist, with a good outfit and with fair experience. However, it will be found quite easy, with a Gifford's F line-screen and an ordinary paraffin lamp with a $\frac{1}{2}$-in. wick, to see Grayson's 25,000-band with the long tube 24 mm., and the 55,000-band with the apochromat 12 mm. A Leitz short tube No. 6 will show the 60,000 very strongly, and the No. 7 the 70,000 nearly as strongly. Results such as these ought to be within the grasp of every microscopist engaged upon serious work.

The improvements in the optical portions of telescopes and microscopes consist in the increase of the $\frac{\text{aperture}}{\text{focus}}$ ratio. The earliest achromatics by John Dollond had apertures equal to $\frac{f}{30}$; those by Thomas Cooke were $\frac{f}{15}$; the last Greenwich telescope is $\frac{f}{12}$; Zeiss apochromats are $\frac{f}{12}$ to $\frac{f}{15}$. As the denominators become smaller, the difficulties opticians have to overcome enormously increase. In camera lenses a modern anastigmat at $\frac{f}{8}$ yields sharper definition than an old rapid rectilinear did at $\frac{f}{16}$. But what are we to say of microscopical apertures? Any lens of 0·5 N.A. has an aperture of $\frac{f}{1}$, and similarly, a lens of N.A. 1·0 has an aperture of $\frac{f}{\frac{1}{2}}$.

In the face of these facts, it can hardly be expected that the practical telescope limit, where c is a trifle less than unity, can be maintained as a microscope limit.

Passing on, an answer must be found for the important question, What are the actual telescope and microscope limits? Is the Airy theoretical limit of $\frac{5''\cdot 55}{a}$ to be accepted, or is the Dawes'

practical limit of $\frac{4'' \cdot 55}{a}$ to remain, or is a new value to be found? In reply, first, the theoretical limit may be dismissed at once, as being quite hopeless. The physical nature of the image at the focal point is not yet fully understood, consequently the mathematical deductions do not agree with the practical results. Secondly, it is probable that Dawes' limit, which has proved serviceable for so many years, will require a very slight modification on account of the improvement in the correction of modern telescope object-glasses. It might be suggested that $4'' \cdot 5$, divided by the aperture of the object-glass in inches, would more nearly represent the separating power of the best telescopes at the present time—this gives c a value of $0 \cdot 988$. With regard to the microscope limit, it is not to be expected that objectives, possessing such a large $\frac{\text{aperture}}{\text{focus}}$ ratio as those of a microscope, can have a limit equal to those for a telescope, with a ratio which is ten, or twenty, times smaller.

Now the microscope limit, printed at the end of the Journal, is a limit for a certain class of physical experiments performed with a microscope when used in a certain manner, and it in no way represents a limit for a microscope when legitimately used for the purposes for which it is intended. A microscope objective differs from a telescope object-glass, inasmuch as a telescope object-glass is always used at full power, not so a microscope objective; the greater part of practical work is done with a half or three-quarter cone of illumination, and only in exceptional cases is this last amount exceeded. Excepting very low powers, it is only objectives of the highest excellence that will stand a $\frac{7}{8}$ cone, and the best oil-immersions will not stand even this. No physicist has, so far as I am aware, offered any explanation of the phenomenon. They have all, with the exception of the late Professor Abbe, treated the microscope lens as if it were a telescope object-glass, with the light spread over its entire surface. Professor Abbe, on the other hand, ignored the centre (in fact, he went so far as to recommend for the highest class of work that it should be stopped out), and confined his investigation to the two small areas at either extremity of a diameter of the aperture. It is upon this investigation that the table of limits, printed at the end of the Journal, is based.

A biologist reports to a society the discovery of some minute structure, stating that it was made with a $\frac{1}{12}$ of $1 \cdot 3$ N.A., withholding the important fact that he had only used a third of the aperture of his lens, having illuminated the object with a cone of $0 \cdot 4$ N.A. from an ordinary Abbe condenser. This is a typical case of daily occurrence. Suppose, now, an astronomer

stated that he had observed a minute rill on the moon with his 8-in. achromatic, and withheld the information that the aperture had been stopped down to 3 in. Now, as an 8-in. will show a rill on the moon $\frac{2}{3}$ of a mile wide, and a 3-in. a rill $1\frac{3}{4}$ miles wide, his statement would not be of much value, for his audience will think he is talking about a rill $\frac{2}{3}$ of a mile wide, whereas the one he saw must have been at least $2\frac{1}{2}$ times wider.

As it is impossible to practically use the full aperture of most microscope objectives, a table, constructed upon an assumption that a narrow portion at the periphery of a lens is the determining factor for the limit, can only lead to wrong conclusions. If, to refer back to our hypothetical astronomer, it had been the accepted practice in the astronomical world to diminish the aperture of a telescope object-glass $2\frac{1}{2}$ times before estimating its limit, no false impression would have been produced among the audience; but the audience of the biologist, on the other hand, having been informed by the table at the end of the Journal that the screen limit for a 1·3 N.A. is 135,800 lines to an inch, is led to believe that the discovered structure is much smaller than it really is. In the Journal for 1893, p. 17, there is a table, "constructed to meet the every-day wants of the practical microscopist," which gave the resolving limit for objectives with a $\frac{3}{4}$ cone; κ was 46,666, and c was 1·333, therefore the limit for N.A. 1·0 was 70,000 lines to an inch. During the thirteen years since that table was written, although apochromatic objectives remain pretty much as they were then, cheap semi-apochromats have been greatly improved, and some containing fluorite can now be purchased at a very moderate price, which in point of excellence run even apochromats very closely. In this interval, too, Mr. H. J. Grayson has produced his wonderful band-plates, which have greatly aided the practical establishment of a more accurate limit. It was thought better to draw up a new table, for the same purpose as the old; and as it was to be a table of "working limits," rather than one of absolute limits, c was made 1·3, so the difference between the two tables is not great. The limit in the following table will only be exceeded by a very few apochromats of super-excellent quality.

A reference to the table shows that the structure discovered by our biologist must have been a good deal less than 104,500 lines to the inch, because that figure is the screen limit for a 1·3 N.A. with nearly a $\frac{7}{9}$ cone, and that if this quantity be halved, for, say, a $\frac{2}{3}$ cone, the result will not be so very far from the truth.

It would be an excellent plan if the announcement of any microscopical discovery were accompanied not only with a description of the objective and magnifying power, as at present, but also with the Grayson band resolved, without the alteration of any of the adjustments except the focus: e.g. an investigator having made

Numerical Aperture. ($n \sin u = a$)	$\kappa = \frac{1}{\lambda}$ $c = 1·3$		Working Limits $= \frac{2\,\text{N.A.}\,\kappa}{c}$				Illuminating Power $(\text{W.A.})^2 = \left(\frac{\text{N.A.}}{c}\right)^2$	Penetrating Power $\frac{1}{\text{W.A.}} = \frac{c}{\text{N.A.}}$
	White Light. $\lambda = 0·5607\ \mu$. Number of lines		Blue Light. $\lambda = 0·4861\ \mu$. Number of lines		Photography. $\lambda = 0·4000\ \mu$. Number of lines			
	in $\frac{1}{100}$ in.	in $\frac{1}{10}$ mm.	in $\frac{1}{100}$ in.	in $\frac{1}{10}$ mm.	in $\frac{1}{100}$ in.	in $\frac{1}{10}$ mm.		
0·025	17	7	20	8	24	10	·0004	52·0
0·050	35	14	40	16	49	19	·0015	26·0
0·075	52	21	60	24	73	29	·0033	17·3
0·100	70	27	80	32	98	38	·0059	13·0
0·125	87	34	100	40	122	48	·0092	10·4
0·150	105	41	121	47	146	58	·013	8·7
0·175	122	48	141	55	171	67	·018	7·4
0·200	139	55	161	63	195	77	·024	6·5
0·225	157	62	181	71	220	87	·030	5·8
0·250	174	69	201	79	244	96	·037	5·2
0·275	192	75	221	87	269	106	·045	4·7
0·300	209	82	241	95	293	115	·053	4·3
0·325	226	89	261	103	317	125	·063	4·0
0·350	244	96	281	111	342	135	·072	3·7
0·375	261	103	301	119	366	144	·083	3·5
0·400	279	110	321	127	391	154	·094	3·2
0·425	296	117	342	135	415	163	·11	3·1
0·450	314	123	362	142	439	173	·12	2·9
0·475	331	130	382	150	464	183	·13	2·7
0·500	348	137	402	158	488	192	·15	2·6
0·525	366	144	422	166	513	202	·16	2·5
0·550	383	151	442	174	537	212	·18	2·4
0·575	401	158	462	182	562	221	·20	2·3
0·600	418	165	482	190	586	231	·21	2·2
0·625	435	171	502	198	610	240	·23	2·1
0·650	453	178	522	206	635	250	·25	2·0
0·675	470	185	542	214	659	260	·27	1·9
0·700	488	192	563	222	684	269	·29	1·9
0·725	505	199	583	229	708	279	·31	1·8
0·750	523	206	603	237	732	288	·33	1·7
0·775	540	213	623	245	757	298	·36	1·7
0·800	557	220	643	253	781	308	·38	1·6
0·825	575	226	663	261	806	317	·40	1·6
0·850	592	233	683	269	830	327	·43	1·5
0·875	610	240	703	277	855	337	·45	1·5
0·900	627	247	723	285	879	346	·48	1·4
0·925	644	254	743	293	903	356	·51	1·4
0·950	662	261	763	301	928	365	·53	1·4
0·975	679	268	784	309	952	375	·56	1·3
1·00	697	274	804	316	977	385	·59	1·3
1·05	732	288	844	332	1025	404	·65	1·2
1·10	766	302	884	348	1074	423	·72	1·2
1·15	801	316	924	364	1123	442	·78	1·1
1·20	836	329	964	380	1172	462	·85	1·1
1·25	871	343	1005	396	1221	481	·92	1 0
1·30	906	357	1045	411	1270	500	1·0	1·0
1·35	941	370	1085	427	1318	519	1·1	·96
1·40	975	384	1125	443	1367	538	1.2	·93
1·45	1010	398	1165	459	1416	558	1·2	·90
1·50	1045	412	1205	475	1465	577	1·3	·87
1·55	1080	425	1246	491	1514	596	1·4	·84
1·60	1115	439	1286	506	1563	615	1·5	·81

a discovery, should remove the slide and place a Grayson's band-plate upon his stage, and see which band was resolved, without disturbing the illumination or any of the adjustments except the focus. The discovery should be recorded as follows: Structure seen, oil immersion $\frac{1}{12}$ N.A. 1·3, comp. ocular 12, × 1500, Gifford screen, Grayson band 60,000. A statement such as this clears the announcement of all ambiguity, and it becomes apparent that either his objective, apparatus, or eyesight must have been defective, or else a small cone of illumination was employed. But in the absence of any such additional information, the conclusion one would naturally come to, with the table of limits printed at the end of the Journal before them, would be that the capacity of the investigator's apparatus was about 135,000 to the inch.

The statement made in my former paper,* to the effect that a screen did not make any difference in the limit with apertures higher than 0·8 N.A., requires correction. I have altered my opinion with regard to the effect of the blue-green screen. The experiments upon which the previous statement was based were performed with a light from a $\frac{1}{2}$-in. paraffin wick, but, in order to bring out the effect of a screen, a much more powerful illuminant is required. An ordinary acetylene bicycle lamp will be found an admirable illuminant for high power microscopical work with screens. I believe the photographic limit with a wave-length of 0·4 μ is too high, the true photographic limit being much the same as the screen limit.

Probably the strongest resolving lens in existence, for its aperture, is the Zeiss long tube apochromatic 4 mm. This lens will visually resolve, with a screen, the *Amphipleura pellucida*, but no one has ever heard or seen a photograph of Grayson's 120,000 band taken with this lens, which, according to the 0·4 μ wave-length photographic table, is within its grip.

It will be seen that this table differs in form from that at the end of the Journal. First, the three columns of equivalents in angular aperture are omitted. The information that an oil-immersion of 40° of aperture, a lens which is not made, and never has been made, is the equivalent of a water-immersion of 46° 2′, which is also a lens that has never been made, was thought to be hardly worth the space. In place of these three columns, the number of lines in the $\frac{1}{10}$ of a millimetre are given. The total number of figures has been reduced, by giving the number of lines in the $\frac{1}{100}$ of an inch, which in no way impairs the usefulness of the table. W.A. is equal to $\frac{\text{N.A.}}{c}$: this equivalent is used at the head of the columns of illuminating and penetrating powers; these functions of a lens depend upon the amount of aperture *utilised*, and not upon

* This Journal, 1898, p. 25.

the total aperture of the lens, which in most cases can never be utilised. The table has been arranged according to ascending, instead of descending values of N.A. Limits are given for each 0·025 N.A., from 0 to 1·0, after that for each 0·05 N.A. In the table at the end of the Journal the low apertures advance by 0·05 N.A., and the wider apertures by 0·01; the result being, that the percentage of the differences in the number of lines to an inch, in the low apertures, is very great, and in the wide apertures very small. At 0·2 N.A. it is as much as 25 p.c., and at 1·4 N.A. it is 0·7 p.c. The plan adopted in the present table tends to level up these differences, for at 0·2 N.A. it is 11 p.c., and at 1·4 N.A. it is 3½ p.c.

A table somewhat similar to this has been of much service to the author. This new one has been put forward in the hope that it may be found useful by some of the Fellows of this Society.

XI.—*On the Influence on Images of Gratings of Phase-Differences amongst their Spectra.*

By J. Rheinberg.

(*Read June 20th*, 1906.)

Some interesting points in regard to the above subject are brought forward by Dr. Karl Strehl, of Erlangen, in the "Zeitschrift für wissenschaftliche Mikroskopie" of last September.

In his booklet on the "Theory of Microscopic Vision," published in 1900,* Dr. Strehl has referred to *phase-differences occurring in the diffraction spectra of complementary structures*. He there applies Babinet's principle, reasoning that, since the transparent portions of the two complementary structures together make up a surface of even illumination, the diffraction spectra of the two complementary structures must together be equivalent to the diffraction spectrum which the evenly illuminated surface would give, viz. a single undiffracted maximum. From which it follows that, whilst the zero maximum in the two sets of spectra would be in the same phase, all the other maxima would have to cancel out, and would, therefore, be opposed to each other in phase.

He now shows how this fits in with the experiments and results forming the subject of my two notes to this Journal,† which he reviews.

To follow matters more clearly, it may be useful to briefly re-state to what differences in phase are due, as they arise from two distinct and different causes, viz. :—

1. *The phase-differences in the diffraction spectra of gratings which arise from the position of the grating on the stage of the Microscope*, and which were, I believe, first pointed out by R. T. Glazebrook.

Given a grating, so placed that one of its slits is on the optic axis of the Microscope. If illuminated by plane waves, diffraction spectra will, of course, be formed in the back focal plane of the objective. Shift the grating in the stage through half a grating interval, so that one of its bars is on the optic axis. Whilst the grating is shifted, and its image in the view plane is shifted, the diffraction spectra retain their position unaltered; the movement of the image in the view plane is accounted for by the changes of phase which occur in the spectra.

Professor Everett showed that, whilst the grating moves through

* The Blaesings Universitäts-Buchhandlung Erlangen.
† 1904, pp. 388–390; 1905, pp. 152–155.

one grating interval on the stage, the zero maximum of the diffraction spectra remains unchanged, the first maximum passes through one complete phase period, the second maxima through two complete phase periods, the third through three periods, and so on. From which it is readily seen that if a grating has been moved by exactly half a grating interval, the zero, second, fourth, and every alternate maximum will have the same phase as before, whilst there will be a difference in the phase of the first, third, and every alternate maximum of exactly half a phase period.

2. *The phase-differences in the spectra of gratings, which depend on the relative width of the slits to the bars,* as first pointed out by Mr. A. E. Conrady.

That in the diffraction spectrum arising from a star disk—and, therefore, also in that of a single slit—there is a phase-difference of half a period between consecutive maxima, was, it appears, first shown by Sir George Airy.

If we plot out the position of the diffraction maxima of a regular grating on the curve of diffraction pattern of one of its slits, then the maxima which are situated between the first and second, or between the third and fourth minima of the single slit pattern, will differ by just half a phase period from those that are situate between the two first minima, or between the second and third, or fourth and fifth minima of the single slit pattern.

The relative width of the slits to the bars determines the position of the maxima of the grating on the diffraction pattern of one of its slits.

Whenever the slits are wider than the bars, then one diffracted maximum only is formed between the centre and the first minimum of the single slot pattern. From which it follows that in this case the first maximum of the grating and the central, zero, or undiffracted maximum are alike in phase, whilst the second maximum will differ by half a phase period.

When the bars are wider than the slits, then two or more of the diffracted maxima of the grating fall between the centre and first minimum of the single slit pattern. Such maxima will be in the same phase as the central or zero maximum.

In the photographs appended to my last note, an example is seen of the effects which may be produced by these phase-differences, in the case of a reciprocal grating in which the ratio of the slits to the bars is 1–2 in the upper, and 2–1 in the lower half. Although in a reciprocal grating the position of the slits in the upper half corresponds to the position of the bars in the lower half, when all but the first and second maxima are blocked out in the back focal plane of the objective, the image in the view plane shows the slits in both upper and lower part of the grating coinciding in position.

Dr. Strehl's method of explaining this is as follows :—Pointing

out that a reciprocal grating consists of two complementary structures, and assuming that the grating lies on the stage, so that one of the comparatively narrow slits in its upper half is on the optic axis, then the zero, first and second maxima, are, as we have seen above, alike in phase. Call them + + +. Now if one of the comparatively wide slits in the lower half of the grating were on the optic axis, then, as we have seen above, the second maximum would differ in phase from the zero and first by half a phase period, so the three maxima would be represented by + + −. But we cannot have one of the slits in both upper and lower half of the reciprocal grating in the optic axis at the same time, for if a slit of the upper half lies on the axis, then a bar of the lower half must be there. That comes to the same thing as if the lower half of the grating had been shifted by half a grating interval, and this change in position, as was shown under (1), necessitates half a phase period difference in the first spectrum, whilst the second remains unchanged. Consequently, we actually have the phases of the lower half of the grating + − −, i.e. the zero spectrum remains in the same phase as that of the upper half of the grating, whilst the other spectra are opposed in phase.

All except the zero maximum cancel out, just as from Babinet's principle we should be led to expect.

It will be seen that Dr. Strehl has thus in a particularly simple way harmonised specific results with the general theory of diffraction by complementary structures.

SUMMARY OF CURRENT RESEARCHES

RELATING TO

ZOOLOGY AND BOTANY

(PRINCIPALLY INVERTEBRATA AND CRYPTOGAMIA),

MICROSCOPY, ETC.*

ZOOLOGY.

VERTEBRATA.

a. Embryology.†

Inheritance of Coat Colour in Horses.‡—C. C. Hurst has inferred from an examination of Weatherby's "General Stud Book of Race Horses" that in modern thoroughbred horses chestnut colour is a Mendelian recessive to bay and brown, which are dominant characters. The consideration of other colours being excluded, bays and browns are of two kinds:—(*a*) Those that when mated with chestnuts will give no chestnut offspring; (*b*) Those that when mated with chestnuts will give on an average, half their offspring chestnuts and the remainder bays and browns. Similarly, the recessive chestnuts, variously extracted from the dominant bays and browns, breed true, as a rule, when mated together, without reversion to their bay or brown ancestors. Nine exceptions were found in 1104 cases, and these may be due to errors in the records.

The late Professor W. F. R. Weldon § studying the same subject reached the following conclusions:—

1. No simple Mendelian view of the relation between chestnut, bay, and brown, regarding chestnut as a simple recessive, can be maintained.

2. The chance of getting a chestnut foal from a chestnut mare is not constant for sires of any colour whatever, and there is no indication that sires of any colour can be sorted into groups such that those in each group will give chestnut foals in a Mendelian proportion when mated with chestnut mares.

* The Society are not intended to be denoted by the editorial "we," and they do not hold themselves responsible for the views of the authors of the papers noted, nor for any claim to novelty or otherwise made by them. The object of this part of the Journal is to present a summary of the papers *as actually published*, and to describe and illustrate Instruments, Apparatus, etc., which are either new or have not been previously described in this country.

† This section includes not only papers relating to Embryology properly so called, but also those dealing with Evolution, Development, Reproduction, and allied subjects.

‡ Proc. Roy. Soc., Series B, lxxvii., No. B 519, pp. 388–94.

§ Tom. cit., pp. 394–8.

3. These points, together with the values for parental and grand-parental correlations already given by Professor Pearson, make it probable that the facts of inheritance of coat colour in horses can be expressed in terms of the hypothesis outlined by Mr. Galton in 1872.

Hurst replies to these objections.

Heredity of Hair-length in Guinea-pig.*—W. E. Castle and A. Forbes find that while long-haired and short-haired conditions are sharply alternative to each other in heredity, the gametes formed by cross breeds are not in all cases pure. Frequently they consist of a blend or a mixture of the two alternative conditions, constituting in effect a new condition intermediate between the other two. This is in accordance with the results obtained for other characters, e.g. albinism, alternative in heredity. It is concluded that gametic purity is not absolute, even in sharply alternative inheritance.

Origin of Polydactylous Race of Guinea-pigs.†—W. E. Castle, having found that in guinea-pigs not infrequently a fourth digit, or "extra toe," occurs on the hind limb, set himself the task of establishing a race of four-toed examples. This was successfully accomplished from the progeny of a single polydactylous individual, and the present paper gives a detailed account of how it was done. It is evident from facts submitted that the inheritance of the extra toe is not a case of simple Mendelian dominance; most polydactylous parents in mating with normal individuals give a mixture of normal and polydactylous offspring, rarely equal to each other in number—the expectation if one parent be a Mendelian heterozygote and the other pure. There is, however, some evidence of Mendelian segregation, and on the whole it seems probable that the extra toe is inherited in a manner intermediate between blending and alternative inheritance.

Theory of Development.‡ — W. Wedekind propounds a theory according to which alternation of generations was universally the most primitive form of ontogeny. By a process of constant abridgment "metamorphosis" has arisen therefrom, and through continuous acceleration of the ontogeny "direct development" has ensued from alternation of generations and metamorphosis. "Direct development is everywhere the secondary process, which, in consequence of its great rapidity, is well nigh incomprehensible." This theory is briefly enunciated, and the advantages and difficulties in the way of its acceptance are considered. Further development in fuller detail is promised in connection with the author's theory of parthenogenesis and determination of sex in higher animals.

Aortic Arches in Mammals.§—F. T. Lewis has investigated in particular the problem of the posterior aortic arches and the related pharyngeal pouches in the rabbit and pig. The order of development of the posterior part of the branchial system appears to be as follows :—

* Carnegie Inst. of Washington Publications, No. 49 (1906) pp. 5-14.

† Tom. cit., pp. 17-29.

‡ Zool. Anzeig., xxix. (1906) pp. 790-5. See also Ann. Mag. Nat. Hist., xviii. (1906) pp. 38-44.

§ Anat. Anzeig., xxviii. (1906) pp. 506-13 (2 figs.).

After the formation of the third pouch and of the fourth aortic arch behind it, the position of the post-branchial body can be identified at the postero-lateral corner of the pharynx. The pulmonary arch then develops behind this body with an irregular, often double, connection with the dorsal aorta. After the pulmonary arch is complete the fourth pouch appears. The interpretation of the post-branchial body in mammals as a fifth pouch, and of the irregular vessels in front of it as a fifth arch, is not supported by the author's observations.

Development of Sesamoid Bone.*—O. Charnock Bradley has investigated the development of the inter-phalangeal sesamoid in several Ungulates and in the rabbit. In all forms examined the flexor tendon is well developed before any indications appear of cartilage in the position ultimately occupied by the sesamoid bone. The development is essentially the same in Ungulates and in the rabbit. The sesamoid is at no period intra-tendinous, but from the first is clearly peri-articular in character. It is probable that this sesamoid represents an ossification in a ligament homologous with the glenoid ligament of the distal inter-phalangeal articulation of man. An interesting point is that in the pig, where the third and fourth digits are the real weight-bearers, the sesamoid is not confined to these, but is present in all the digits.

Structure and Development of Ovary and Testis of Cat.†—G. Sainmont has investigated these by the study of a number of embryos. His leading conclusions are that the interstitial cell is a connective cell differentiated like all adipose cells in other connective tissues. It has a trophic role to the epithelial organs of the ovary and testis, but an internal secretory function is only problematic. The author in a postscript points out a parallelism between the development of this tissue in the testis of the horse (as investigated by Bouin and Ancel) and in the ovary of the cat.

Development of Sex Structures in Marsupials.‡—A. J. P. van den Broek gives an account of certain phases in the development and relations of the Wolffian and Müllerian ducts and other related parts as observed in *Didelphys*, *Dasyurus*, and *Sminthopsis*. Some of his points may be noted. The sex cords in the male remain during the whole period of development completely separated. In the female at the time of highest development of the primitive kidney they are separate throughout their extent; afterwards they unite about the middle of their course at the level of the later developed uterus and its junction with the vagina. The Müllerian duct appears to arise quite independently and free from the Wolffian. As in other mammals and in man, the germinal gland already shows sexual differentiation before the Müllerian duct is completely developed. The relations of the two ducts to each other are described fully. The course of the ureters is also indicated, and it is noted that in a specimen of *Sminthopsis crassicaudata* of 13·2 mm. the ureters opened hypocystically, thus showing a relation to the Wolffian ducts such as persists throughout life in

* Anat. Anzeig., xxviii. (1906) pp. 528-36 (5 figs.).
† Arch. de Biol., xxii. (1906) fasc. 1, pp. 71-161 (6 pls.).
‡ Anat. Anzeig., xxviii. (1906) pp. 579-94 (13 figs.).

Monotremes. It is not known whether the condition observed was unusual or not.

Development and Structure of Fins.*—E. S. Goodrich deals with the development, structure, and origin of the median and paired fins of fishes. He has made a series of observations on embryos of *Scyllium canicula*, and concludes that the development of the median dorsal fins is essentially similar to that of the paired fins. They arise as longitudinal folds into which grow buds from the myotomes. There is early concentration, chiefly due to the body growing faster than the fin. Neither the study of development nor of the adult structure affords any definite evidence that the primitive metamerism of the musculature is lost. All the fins remain throughout development in approximately the same position. Apparent change of place may be brought about by concentration being greater in the one direction than in the other. This is especially the case with the dorsal fins: the results give strong support to the lateral fold theory of the origin of paired fins, and their general bearing is fully discussed.

Functional View of Development.†—M. E. Henriksen propounds a functional view of development in relation to which Weismann's theory of the structure of the germ-plasm is unnecessary. According to this view, "the adult organism is not predelineated nor singly predetermined in the egg, but develops by progressive steps, one part dependent on the other, to establish proper relations within the cells as well as among the cells, and when properly nourished and in proper environment it will establish the equilibrium of the species; it will form a body much like that of the parent." The physiological interactions of the parts of the cell constitute the all-determining factor for establishing the relations between the blastomeres, and thus in a progressive manner the organism reaches a state of equilibrium peculiar to that of the species. Since each successive step in development is dependent on the preceding, it necessarily follows that the ontogeny must be a shortened recapitulation of the phylogeny of the organism. In support of his views the author discusses the results of recent experimental embryology, showing that inheritance is independent of structure—is, in fact, a functional problem.

Text-Book of Teratology.‡—E. Schwalbe has completed the first part of a text-book on teratology, which will be welcomed by many investigators. He discusses the facts in the light of embryology, comparative anatomy, and pathology. We may call attention to the chapters on experimental teratology, on regenerative and regulative processes, on the formal and causal genesis of abnormalities, and on their classification.

Bull with a Supernumerary Limb.§—José Rioja y Martin communicates two photographs of a bull with a supernumerary leg of large size, arising dorsally above the shoulder, curving downwards and forwards, and ending in five huge curved claws.

* Quart. Journ. Micr. Sci., No. 198 (1906) pp. 333–76 (5 pls.).
† Biol. Centralbl., xxvi. (1906) pp. 18–24, 33–7.
‡ Die Morphologie der Missbildungen des Menschen und der Tiere. Ein Lehrbuch für Morphologen, Physiologen, praktische Aerzte und Studierende. I Teil. Allgemeine Missbildungslehre (Teratologie). Jena, 1906.
§ Boll. R. Soc. Españ. Hist. Nat., v. (1905) p. 415 (2 pls.).

Hypermely in the Frog.*—O. Bender has studied a case of a supernumerary hind leg in the frog. He gives a full description of the skeletal parts and the musculature, and discusses the question of origin. He supposes that at a very early stage some unknown agency divided the blastema of the appendages into unequal parts, the smaller of which, not containing a full complement of parts, developed into a defective extra limb.

Origin of Supernumerary Limbs.†—Ludwig v. Méhely describes an interesting case of a toad (*Pelobates fuscus*) with three fore-limbs on the left side, one the original member, a second the super-regenerated left, and a third the corresponding right. In this hexapod animal there were three shoulder-girdles on the left side—three pre-coracoids, three coracoids, three scapulæ, and a minute description of the maze of bones is given. The cause was doubtless a wound, and from each wound-surface a regeneration of the peripheral parts has gone on. The author discusses the general question of regeneration. It is necessary to recognise the physiological unity of parts like appendages, but it is not necessary to postulate any teleological principle.

Cell Communications between Blastomeres.‡—Cresswell Sheurer describes delicate intercellular strands connecting one blastomere with another in the developing ova of the Serpulid *Eupomatus* and in the gastrula of *Polygordius*. He discusses similar cell communications which other investigators have recorded. Our conception of the cell-theory needs some remodelling, as Sedgwick, Whitman, and Meyer have pointed out. In the words of Sachs, cells are "merely one of the numerous expressions of the formative forces which reside in all matter."

Behaviour of Vertebrate Spermatozoa in Solutions.§—H. Adolphi has investigated the behaviour of spermatozoa of various mammals, birds, amphibians, and fishes, with particular reference to currents. In the case of mammals, for example, in salt solution where there is no current they swim in straight lines in all directions, getting up a speed of about 40 μ per second. Against a stream of 100 μ per second they fought hard but were carried back. In streams of from 10 μ to 17 μ they swam against the current with a speed of 33 μ to 25 μ per second. A stream of 5 μ has no directing influence. Similar results in general were obtained for birds. It is suggested that the pressing forward of the spermatozoa to the tube funnel of the oviduct is due to this peculiarity of going against the stream. Frogs' spermatozoa, however, also swim against the stream, a fact which can have no significance for fertilisation. In fishes, the sperms of most individuals as far as investigated appear to swim in circles. The decided swimming against the stream evident in mammals is quite absent in fishes.

Factors Determining Growth and Activity of Mammary Glands.‖ J. E. Lane-Claypon and E. H. Starling have made experiments which

* Morph. Jahrb., xxxv. (1906) pp. 395–412 (1 pl.).
† Math. Nat. Ber. Ungarn, xx. (1905) pp. 239–59 (9 figs.).
‡ Proc. Roy. Soc., Series B, lxxvii., No. B 520 (1906) pp. 498–505 (1 pl.).
§ Anat. Anzeig., xxviii. (1906) pp. 138–49 (2 figs.).
‖ Proc. Roy. Soc., Series B, lxxvii. No. B 520 (1906). pp. 505–22 (1 pl.).

go to show that the growth of the mammary glands during pregnancy is due to the action of a specific chemical stimulus produced in the fertilised ovum. The amount of this substance increases with the growth of the fœtus. Lactation is due to the removal of this substance, which is regarded as exerting an inhibitory influence on the gland-cells, hindering their secretory activity and furthering their growth. It is also suggested that the specific substance is diffusible. It is not claimed, however, that these conclusions are as yet firmly established.

Placenta of Tragulus.*—Ciro Barbieri finds that the placenta of *Tragulus meminna* is typically diffuse, like that in pigs and horses. In *Tr. javanicus* there is this slight difference, that there is a partial atrophy of villi on the antimesometral side of the uterus. The superficial internal layers of the uterus are extraordinarily rich in leucocytes, which continuously engulf and assimilate the epithelial cells of the placental villi.

Breeding Habits of Pipe-Fish.†—E. W. Gudger gives an interesting account of the "Liebesspiel" of *Siphostoma floridæ* preparatory to the act of copulation. Both sexes swim around with their bodies in nearly vertical positions, but with head and shoulders sharply bent forward like the letter *f*. "Then they swim slowly past each other, their bodies touching, and the male being perhaps more demonstrative. Just before the actual transfer, the male becomes violently excited and demonstrative, shakes his head and anterior body parts in a corkscrew fashion, and with his snout caresses the female on the belly. The female responds to this, but does not become so excited. This is repeated several times, the fishes becoming more excited each time they touch each other. Presently, quick as a flash, the sexual embrace takes place, and then the fishes separate to begin again in a few minutes." The embrace consists in the fishes intertwining their bodies like two letter *S*'s, the one reversed on the other, thus bringing them face to face. Thus they hold their bodies together while the eggs pass from the oviduct into the pouch of the male, fertilisation presumably taking place at this moment. Before the complete transfer is effected several contacts are made. The process is so carried out that any contact of the eggs and sperms with the sea water is absolutely prevented. The pouch and its contents appear to act as a "physiological placenta"; the eggs and embryos depend on it for oxygen and food, and cannot survive out of it. The author has followed the segmentation of the egg through a considerable number of stages, and these he describes.

b. Histology.

Nerve-Endings in the Lung.‡—F. Ponzio concludes that in the lung there are no true nerve terminations. There are terminal networks which envelop and interpenetrate the cells investing the minute bronchioles, the alveoli, and the capillaries. The richness and intricacy of this nervous apparatus are probably an index of its great functional importance.

* Anat. Anzeig., xxviii. (1906) pp. 327–36 (5 figs.).
† Proc. U.S. National Museum, xxix. (1905) pp. 447–500 (7 pls.).
‡ Anat. Anzeig., xxviii. (1906) pp. 74–80 (1 pl.).

Plasma Cells in Human Gasserian Ganglion.*—E. Meyer directs attention to the occurrence of numerous plasma-cells in the apparently quite normal Gasserian ganglion. They are quite similar to those which occur in inflammatory and degenerative conditions. It is possible that they may be auxiliary cells mediating between the blood and the intensely active ganglion cells.

Histology of Sex Cells.†—E. Sjövall finds that the so-called "Binnennetz" of Golgi and Kopsch, occurring in the spinal ganglion cells, are by no means confined to them, but are frequent in other types of cell during the whole embryonic period. He has investigated this "Binnennetz" in the sex-cells of white mice during spermato- and ovogenesis. The net appears topographically to have an intimate connection with the idiosome, but is really different in character and independent in development. Its significance is by no means clear, yet it is undoubtedly important. It is transmitted to the cells of the new generation from the ovum only—the male sex-cell taking no part in its formation.

Ciliated Epithelium in Human Papillæ vallatæ.‡—F. Heiderich describes several cases in which he has found a many-layered epithelium about 54 μ thick, bearing cilia 10–12 μ in length on the papillæ vallatæ. This epithelium was limited to a small space and occurred only on quite protected places. It had no relation to the minute glands lying in and under the papillæ.

Fat Cells in Acipenser.§—A. Nemiloff describes these cells in *Acipenser ruthenus*. Of particular interest is a protoplasmic network penetrating throughout the cells which the author is certain is not an artifact. This network in fat-cells, it appears, has not been observed in other vertebrates.

Structure of Vagina and Uterus in Mammals.‖—K. Beiling gives a detailed account of the structure, both micro- and macroscopic, of the mammalian vagina and uterus. A wide range of types has been examined, viz.: mole, rat, rabbit, guinea-pig, dog, cat, pig, goat, ape, etc. Only a few of his results can be given. The wall of the genital canal—vagina, uterus, and tubes—consists of three layers, a mucous membrane, muscularis, and serosa. This last is absent on a part of the vagina. There is no submucosa. Vagina, cervix, and tubes are devoid of glands. The corpus and cornua uteri possess the long uterine glands; in Carnivora at the period of sexual attraction, smaller glands, the so-called crypts, arise. A periglandular lymph space around the uterine glands is not present. The epithelium of the vagina is simple or stratified, passing over gradually into the one-layered cylindrical epithelium of the uterus and tubes. Mucus occurs only in the epithelium of the cervix canal; special mucus-forming cells or glands are absent, so that the surface epithelium must be regarded as the place of its formation.

* Anat. Anzeig., xxviii. (1906) pp. 81–3 (1 pl.).
† Tom. cit., pp. 561–79 (5 figs.). ‡ Tom. cit., pp. 315–16.
§ Tom. cit., pp. 513–22 (6 figs.).
‖ Arch. Mikr. Anat., lxvii. (1906) heft 4, pp. 573–637 (1 pl.).

Form of Human Blood Corpuscles.*—H. E. Radasch finds that the majority of the red blood-cells in the circulating blood both in fœtus and adult are bell- and not disk-shaped. Contact with the air causes the bells to collapse and assume the disk form.

Number of Chromosomes in Man.†—J. Duesberg notes that there is considerable discrepancy of statement as to the number of chromosomes in man. The number has been given as 16, 18, 24, 32, and so on. Duesberg finds clear evidence that in the spermatocytes the number is 12, and therefore 24 in the spermatogonia and the somatic cells. Thus the number in man is the same as in mouse, salamander, snail, salmon, lily, hellebore, etc.

Suprarenals and Sympathetic System in Protopterus.‡—Ercole Giacomini describes the suprarenal bodies in *Protopterus*. Their segmental association with the intercostal arteries recalls a similar disposition in lampreys. The presence of chromaffin tissue beside the cranial portions of posterior cardinal veins recalls Teleosteans. In their relations with the intercostal arteries, and with the sympathetic, and in their segmental distribution, there is an approach to Elasmobranch conditions. The sympathetic, usually said to be absent, is represented by two very delicate trunks along the sides of the aorta and by distinct traces of ganglia.

c. General.

Mammary Glands and other Skin-Glands of Marsupials.§—H. Eggeling points out that the integumentary glands of Marsupials, like those of Monotremes and higher mammals, fall into two great groups: (*a*) the "vital-secretory," permanently canaliculate, merocrinal glands; and (*b*) the "necrobiotic-secretory" (where the cells are destroyed), temporarily canaliculate, holocrinal glands. The first group includes, besides the various kinds of mucous glands and the so-called sudorific glands, also the mammary glands; the second group includes the so-called sebaceous glands. The close connection between the mammary glands and sudorific glands is corroborated. In the Monotremes epithelial muscular fibres persist in the whole length of the mammary glands; in Marsupials these occur only at particular places; in the higher mammals they seem to have almost entirely disappeared. In the teat-less Monotremes the external musculature of the glandular tubules co-operates in expelling the secretion. In Marsupials the secretion is liberated by the sucking of the young, but there are epithelial muscular elements left to help. In this respect, as in many others, the Marsupials occupy an intermediate position.

Growth of the Bronchial Tree.‖—J. M. Flint describes this in the pig, where there arise from the pulmonary primordium four sets of branches, all of which, with one exception, originate from the stem

* Anat. Anzeig., xxviii. (1906) pp. 600–4.
† Tom. cit., pp. 475–9 (3 figs.).
‡ Atti Rend. R. Accad. Lincei Roma, xv. (1906) pp. 394–6.
§ Semon's Forsch. in Austral. u. d. Malay Archipelago, iv. lief 4, pp. 299–332. See also Zool. Zentralbl., xiii. (1906) pp. 269–70.
‖ Anat. Anzeig., xxviii. (1906) pp. 272–86.

bronchus. There is an unpaired lateral evagination from the wall of the trachea on the right side a short distance above the origin of the two chief bronchi; in certain other animals it is often present on both sides. This evagination occurs early, during the formation of the primitive lung-sacs, in embryos of about 8 mm. long. Subsequent developments are discussed, and the methods of growth of the bronchial tree, as described by various authors, are discussed and criticised.

Experimental Pathology and Animal Classification.*—B. Galli-Valério discusses the significance of recent work, particularly the bearing of the action of precipitins on zoological and botanical classification. These reactions show a close relationship between Hominidæ and Simiidæ, less close between Hominidæ and Cercopithecidæ. The antiserum of Cercopithecidæ, however, gives a more marked precipitant with the blood of Hominidæ and Simiidæ than with that of Cebidæ and Hapalidæ. The blood of lemurs is markedly distinct from that of all Primates.

The antiserum of pigs precipitates Cetacean blood; that of Mammalia generally does not precipitate with Monotremata, and similar tests mark the Marsupials as a distinct group showing relationship with neither. Analogous results with regard to other vertebrates are quoted, as well as those of Decapods and Arachnids. An interesting case is that of *Limulus*, whose antiserum precipitates the blood of Arachnids, but which gives no reaction with that of Decapods. Most of the results quoted in the paper are derived from the work of Nuttall.

Skeleton of Musk Duck.†—W. P. Pycraft gives an account of the peculiarities of the skeleton of this Australian diving bird, *Biziura lobata*, noting specially the characters evolved in relation to its diving habits. Of these may be quoted first the peculiar shape of the lachrymal gland grooves. "There seem to be good grounds for associating the development of this groove with the necessity for a large supra-orbital gland in marine diving birds. This seems to be supported by the fact that in the mergansers, which are fresh-water diving ducks, this groove is wanting and the gland only feebly developed." A parallel case is afforded by the grebes and divers. The former, which are fresh-water divers, have much smaller supra-orbital glands than the latter, which are marine. The occurrence of grebes and mergansers at sea appears to be a recently acquired habit. Long hypapophyses with horizontally expanded plates at the free ends of the spines, occur upon the thoracic vertebræ. "These have undoubtedly been developed to increase the power of diving." The girdles, limbs, and ribs also show special adaptive features.

Organ of Jacobson in Sphenodon.‡—R. Broom, from a study of *Sphenodon* embryos, has been able to investigate the relations of this organ, and to give a detailed account of the same. It is much less developed than in lizards and snakes, and in structure comes nearer to this organ in the Geckos than in the other lizards. In the way in

* Bull. Soc. Vaudoise Sci. Nat., xlii. (1906) pp. 65-70.
† Journ. Linn. Soc. (Zool.) xxix. (1906) pp. 396-407 (1 pl.).
‡ Tom. cit., pp. 414-20 (2 pls.).

which the organ opens into the anterior part of the lower portion of the nasal cavity, the resemblance is much closer to the mammalian condition than to the lacertilian, and in general it may be said that its condition in *Sphenodon* affords additional evidence, if such be required, of the reptilian affinities of the mammalia.

Multiple Testis and Liver.*—H. Gerhartz gives particulars of two cases of *Rana fusca* where, in addition to the normal testes, accessory glands were present showing sex-cells in normal development. One of the frogs further showed two minute sago-like structures attached to a vein in the body cavity. These were found to possess a liver structure, with cells apparently in an active condition.

Coloration of Fishes.†—M. Popoff discusses the discoloration of fishes, with especial reference to its interpretation in terms of the formula of natural selection. Almost all fishes are silvery below, and darker above, but there are exceptions. In those living in large rivers, ponds, and seas that are not very clear, the silver of the under-surface is often partially hidden by a dull yellow veil; in Salmonidæ, some of which feed chiefly at night, or habitually hide under stones and water plants, the colour is often brown, or red or dark; in most deep-sea fishes there is usually a dull colour over the whole body.

The silvery coloration is usually associated with clear water. Mandoul has interpreted the silver shimmer as due to pigments of the uric series, to which guanin belongs, and has correlated its prevalence with defective renal organs. But this interpretation by itself is far too general. Thayer's suggestion as to the protective advantage, well seen in some birds, of having a lighter groundwork on the under-surface is then considered, but Popoff finds that it is not generally applicable. When the visual arrangements and powers of fishes are considered, it becomes evident that a lighter coloration on the under-surface will not protect fish against fish. Moreover, the under-surface is not merely light, it is silvery. A careful consideration of the conditions of illumination in the water leads, however, to the conclusion that the silvery under-surface seen against the silvery surface of the water is of great protective value. The author discusses various types of coloration which may be interpreted as in harmony with different conditions in the transparency and illumination of the water. He gives particular attention to the Clupeidæ, the Salmonidæ, the Percidæ, the Gadidæ, and the deep-sea fishes. Of particular interest are cases where different species of the same genus have different coloration in correspondence with their different habits. Thus *Blennius rouxi*, which lives in the clear sea-water, is very silvery, while *B. cagnotha*, which lives in not very clear fresh-water, has a yellowish tint ventrally. Popoff's general conclusion is that the silveriness of the under-surface in fishes is a subtly-developed protective adaptation.

Spiracular Organ in Lepidosiren and Protopterus.‡—W. E. Agar gives some particulars regarding a tubular organ "enclosed in a hoop of cartilage springing from the lateral wall of the auditory capsule." A

* Anat. Anzeig., xxviii. (1906) pp. 522–8.
† Biol. Centralbl., xxvi. (1906) pp. 272–82.
‡ Anat. Anzeig., xxviii. (1906) pp. 298–304 (5 figs.).

study of developmental stages shows that it is derived from the epiblastic invagination of the spiracular cleft. It has apparently no relation to the lateral line system of sense organs, and its function is doubtful. From the fact that it is deeply imbedded below the surface, and is intimately connected with one of the efferent branchial arteries, it is suggested that it may function as an organ for testing the osmotic pressure of the blood in these mud-burrowing fishes. The organ apparently does not occur in *Ceratodus*.

Cranial Nerves in Chimæra.*— F. J. Cole and W. J. Dakin describe various nerves and their distribution in *Chimæra*. They note that the discrete nature of the fifth, seventh, and lateral line nerves makes *Chimæra* a unique fish as regards its cranial nerves. It is presumed that such a simple condition is more primitive than the complex fusions and interminglings that obtain in other fishes. This separation may, however, be purely secondary, just as the form of the brain in *Chimæra* undoubtedly is; but, on the other hand, the vagus is also in a very simple and unfused condition. This, indeed, is the condition of the cranial nerves generally.

Membranous Labyrinth in Elasmobranchs.†—C. Stewart describes the membranous labyrinth and its innervation in *Echinorhinus*, *Cestracion*, and *Rhina*. The most noteworthy feature occurs in *Rhina squatina*, where the otoliths are absent, their place being taken by sand-grains introduced from without through the comparatively large external opening of the ductus endolymphaticus. The sand-grains are often partly cemented into a thin plate. It is not likely that the otoliths are got rid of through the external opening, for they were proved absent in the young unborn examples, although occurring in specimens of the same age of *Acanthias vulgaris*.

Vertebrate Fossils of Victoria.‡—A. Smith Woodward describes from the Lower Jurassic of Victoria an interesting tooth, which appears to represent a new species of *Ceratodus*. It differs from all the known Mesozoic teeth of this genus in its narrowness, combined with the straightness of its inner margin and the direction of its second and third denticles. The fossil proves for the first time that the remarkable Dipnoan genus to which it belongs had already reached the Australian region so long ago as the early part of the Jurassic period. At that epoch *Ceratodus* was still living both in Europe and in North America, while it survived in the African and South American regions at least until the Cretaceous period. From the same rock as that in which the tooth occurred a claw of a carnivorous Dinosaur was taken. It appears to represent a genus related to *Megalosaurus*, and a detailed description is given.

Influence of Vertical Currents on Marine Plankton.§— A. Nathansohn finds that Brandt's theory of the influence of denitrifying bacteria on the quantitative distribution of the marine plankton is

* Anat. Anzeig., xxviii. (1906) pp. 595–9 (1 fig.).
† Journ. Linn. Soc., xxix. (1906) pp. 439–42 (1 pl.).
‡ Ann. Mag. Nat. Hist., xviii. (1906) pp. 1–3 (1 pl.).
§ Bull. Mus. Oceanogr. Monaco, No. 62 (1906) pp. 1–12. See also Zool. Zentralbl., xiii. (1906) pp. 225–6.

not in itself sufficient. Nitrifying organisms do not appear regularly in the sea; they arise in the neighbourhood of the continental coasts, and thus the operation of denitrifying bacteria is limited.

Of great importance are the vertical convection-currents which bring the sinking dead plankton to the surface again, and thus enrich the nutritive supply at the surface and allow a stronger development of the plankton. In the Mediterranean, with its very slow vertical circulation, the plankton is sparse, but where there are vertical currents, as at Messina and on the coast of Algiers, it is much richer. This view explains local accumulations of plankton as well as the general distribution. In high latitudes the vertical currents are more marked than in temperate seas; the plankton maximum is at the equator. Many particular cases as well as the general facts show that wherever there are well-developed vertical currents there the plankton is quantitatively rich.

Migration of Plankton in Lakes.*—R. Monti points out that in small shallow clear lakes of the high Alps there is a horizontal migration of the Crustaceans which is apt to vitiate the method of samples. The Entomostraca leave the parts of the surface which are sunny or moved by the wind, and seek the shaded parts. This migration often leads to an accumulation of the whole mass of the plankton in a single bay, and it also affects the vertical distribution.

Arctic Biological Station.†—Martin E. Henriksen reports that a biological station is about to be established on Disco Island, off Greenland, "a well-chosen vantage-ground for the study of arctic biology." It will be open free to investigators, who should communicate with the director, M. P. Porseld, University, Copenhagen. The money for the erection of the station has been supplied by P. Holck, of Copenhagen, and the Danish Government will pay the current expenses. Everyone will wish this new station all success.

Momentum in Variation.‡—F. B. Loomis gives a number of examples—e.g. the crania and teeth in sabre-toothed tigers, horns of Cervidæ, septal edge in Ammonites—to show "that as a special feature develops, it attains a momentum which tends to carry it beyond the point of greatest utility." "A variation started along any line tends to carry that line of development to its ultimate, being driven by momentum." "This factor of momentum has not been given the importance due to it, . . . it should find an important place in the explanation of animal structures." But unless the author can translate momentum into biological terms, he has merely suggested a metaphor.

Marine Fossils from Crete.§—R. A, Bullen records from a large Mammalian bone, of Pleistocene age, found in a cave at Kharoumes, East Crete, a number of Foraminifera, two Polyzoa, valves of Entomostraca, and several marine Mollusca. Their evidence, along with other data, points to oscillations of the land surfaces, leading to their submergence and re-emergence.

* Rend. R. Ist. Lombardo, xxxviii. (1905) pp. 122–32.
† Biol. Centralbl., xxvi. (1906) p. 256.
‡ Amer. Nat., xxxix. (1905) pp. 839–43 (2 figs.).
§ Geol. Magazine, No. 506 (1906) pp. 354–8 (2 pls.).

Tunicata.

Arctic and Antarctic Appendiculariæ.*—H. Lohmann describes five species of *Oikopleura* and two species of *Fritillaria* from polar seas. The only species distributed at both poles is *Fritillaria borealis*, but it occurs in several forms and is practically cosmopolitan. The polar species of *Oikopleura* are characterised by a peculiar disposition of the primordium of the "house," but the arctic and antarctic species are quite distinct. In the antarctic species the gonads invest the gut laterally; in the arctic species they lie in the loop of the gut. According to Lohmann the polar species of Appendiculariæ are in no way old-fashioned or primitive species. On the contrary, the polar species of *Oikopleura* are probably the youngest and most highly developed species of their genus. There is no warrant for supposing a monophyletic origin for the polar Appendiculariæ.

INVERTEBRATA.

Mollusca.

α. Cephalopoda.

Phosphorescent Organ in Cephalopods.†—W. Th. Meyer has examined this organ in *Sepiola rondeletii*; he gives a description along with comparative notes regarding *Heteroteuthis dispar*. The organ in *S. rondeletii* is paired, lying right and left of the hind gut, is of the form of an "ear-shell," and iridescent in the living animal. Three portions are recognisable, one of which is glandular. An interesting feature is the fact that this organ does not occur in all examples; it is absent in one half to three-fifths of them. It is not a case of sexual dimorphism, for the organ may be present or absent in both sexes; further, it may be absent in adults, and it has been found in immature individuals. It is possible that two varieties of *S. rondeletii* exist, whose only distinguishing feature is the presence or absence of this organ. Steenstrup describes two varieties differing amongst other things in the form of the ink-bag. It is a fact that this structure is modified considerably by the presence of the "Leucht-organ."

Sex Organs of Cephalopods.‡—C. Chun gives an account of the sex apparatus in the two deep-sea genera *Calliteuthis* and *Histioteuthis*. W. Marchand describes the male organs of *Ocythoë tuberculata*, discussing the peculiarities of these in the Octopods, while W. T. Meyer deals with the same structures in *Opisthoteuthis depressa*. It would appear that there are a number of points of difference in the male sex apparatus between Octopods and Decapods.

γ. Gastropoda.

Behaviour of Pond Snail.§—H. E. Walter has made a special study of the behaviour and reactions of *Lymnæus elodes* Say. It is negatively

* Zool. Jahrb., Supp. viii., Festschr. f. Möbius, 1905, pp. 353–82 (2 pls.).
† Zool. Anzeig., xxx. (1906) pp. 388–92 (3 figs.).
‡ Op. cit., xxix. (1906) pp. 743–60.
§ Brooklyn Inst. Arts and Sciences, Cold Spring Harbor Monographs, No. 6 (1906) pp. 1–33.

phototactic; negatively geotactic when in need of oxygen, and positively so when supplied with it, but mechanical stimulation interferes somewhat with the character of geotactic responses. Numerous other results are recorded, and it is concluded that with increased knowledge of the animal its actions become the more referable to external stimuli. Nevertheless these responses are constantly modified from within the organism itself by the tonus, or physiological condition, in which the animal chances to be at the time.

Arthropoda.

a. Insecta.

Locomotor Cuticular Outgrowths in Insect Larvæ.*—W. Leisewitz has made a detailed study of (1) undifferentiated hairs, (2) spines resulting from the coalescence of groups of hairs, and fixed to basal plates which may grow into cones, (3) tubercles which result from further growth and, it may be, fusion of basal cones with reduction of the spines, and (4) setæ which are shorter and thicker than the hairs, and are often curved and expanded. Of course there are intermediate forms between hairs and spines, spines and tubercles, hairs and setæ.

The cuticular processes in burrowing larvæ are disposed in relation to locomotor efficiency. Their particular character is adapted to the material in which the larvæ burrow. Their size is correlated with the degree of activity. They always point in a direction opposite to that of locomotion. They afford fine examples of convergence, for the cuticular processes of unrelated larvæ living in similar conditions are often closely alike.

Morphology of Insect Head.†—K. W. Verhoeff has made a detailed study of the head, especially in Thysanura and Dermaptera. He distinguishes three groups of "segments"—

(*a*) Those laid down in the young germinal streak and well developed in the older embryo, e.g. the antennary segments, the 3 jaw-segments, the 3 limb-bearing thoracic segments.

(*b*) Those laid down in the young germinal streak, but less distinct or vestigial in the older embryo, e.g. the præmandibular segment.

(*c*) Those which are as such indistinct in the young germinal streak, but distinct in the post-embryonic stages, e.g. the 3 segments of the protocephalon and the primitive intermediary segments (Urzwischensegmente) on the thorax and abdomen.

Of the 7–8 segments in the head of Thysanura and Dermaptera, 4 belong to group (*a*), 1–2 to group (*b*), and 3 to group (*c*).

He gives an account of these segments and their adult representation: viz. the labral-, clypeopharyngeal-, fronto-ocellar-, antennary-, mandibular-, maxillipod-, and labiopod-segments.

Abdominal Gland-Pockets in Insects.‡—R. Oettinger gives an account of the structure and relations, including certain histological

* Ueber Chitinose Fortbewegungs-apparate einiger (insbesondere fussloser) Insektenlarven, München, 1906, 143 pp., 46 figs. See also Zool. Zentralbl., xiii. (1906) pp. 376–9.

† Nova Acta k. Leopold-Carol. Deutsch. Akad. Nat., lxxxiv. (1905) pp. 1–144 (8 pls.).

‡ Zool. Anzeig., xxx. (1906) pp. 338–49 (9 figs.).

details, of the gland-pouches on the abdomen of *Periplaneta orientalis* and *Phyllodromia germanica*. As to their significance, no definite conclusion is arrived at, although it is noted that in *Periplaneta* they occur in both sexes, in young as well as adult, whereas in *Phyllodromia germanica* they are found in the mature male only. Haase has shown that the secretion of the pockets in *Periplaneta* spreads the characteristically unpleasant smell, while the odour of the organ in *Phyllodromia* is not unpleasant.

Structure and Function of Malpighian Tubules.*—A. Veneziani has investigated these structures with a view to elucidating their biological significance. There appears to be a definite relation between the extent of excretory surface of these tubules and the mass of the body. Their number is not indefinite, they are reducible to three groups of 2, 4, or 6, which may be simple or ramified. They are really parts of the intestine differentiated for a renal function. The colouring matter present in the tubules is definite in composition, resembles urochrome, and is termed entomurochrome. The excreted substances are identical with those of vertebrates (uric acid, urea, urates, phosphates, calcium, oxalates), together with carbonates, leucin, lime salts, and an undetermined acid. The tubules possess gland-cells, identical in structure with renal epithelium. These absorb electively waste materials from the blood, which are excreted through pore-canals and subsequently transported to the exterior. To the excretory function is added that of eliminating colouring matters from the circulation, and of elaborating calcareous material.

Himalayan Ants.†—A. Forel discusses the characteristics of the Himalayan ant fauna. He recognises 54 specialised Himalayan species, 51 Indo-Malay, and 10 Palæarctic. The fauna is very specialised, and comparable to that of the Swiss mountains. Two new species from over 3600 metres are described.

Fossil Hymenoptera from Colorado.‡—T. D. A. Cockerell describes certain Hymenoptera from the Tertiary shales of Florissant, Colorado, probably of Miocene age. In general terms, it may be said that these insects do not differ greatly from their modern representatives. While some of the extinct genera are apparently more primitive than the dominant genera of the same groups to-day, they are scarcely more so than certain genera which still exist in the modern fauna. The types represented do not suggest tropical or sub-tropical conditions; they accord well with the vegetation in indicating a climate like that of the austral zones of the temperate region. The families represented are exactly those dominant to-day in North America, and the absence of certain groups must no doubt be regarded as accidental.

Biology of Hymenopterous Parasites.§—P. Marchal has investigated the development and relations to host of the minute hymenopterous parasites known as Platygasters, belonging to the family

* Redia, ii. (1904) fasc. 2, pp. 177–230 (3 pls.).
† Bull. Soc. Vaudoise Sci. Nat., xlii. (1906) pp. 79–94.
‡ Bull. Mus. Comp. Zool. Harvard, l. (1906) pp. 33–58.
§ Arch. Zool. Expér., iv. sér. 4 (1906) pp. 485–640 (8 pls.).

Proctotrupidæ. Special reference is made to the particular conditions of parasitism in different species, and the reactions provoked in the host's tissues. Six different species are considered, all of them living on the larvæ of Cecidomyiæ. The developing ova usually produce gall-like cysts upon the tissues. *Inostemma piricola*, for example, produces enormous cysts upon the brain of the larva of *Diplosis pirivora*.

Geometridæ of United States.*—R. F. Pearsall gives a list of Geometridæ collected on museum expeditions to Utah, Arizona, and Texas. The list includes a number of new species, which are fully described.

Life-History of Trichoptilus paludum.†—T. A. Chapman gives some observations on the egg, growth of larvæ, and pupation of this the smallest and most delicate of British plume moths. The larva appears to have four instars, and is interesting in the fact that it finds its food plant in *Drosera rotundifolia*. Without any special means of protection it attacks *Drosera* with entire impunity. The glands with their secretion are favourite items of food, especially when the larva is small.

Rest Attitude of Butterflies.‡—G. B. Longstaff records numerous instances of so-called "negative heliotropism" in various butterflies, cases of "inverted attitude" of Lycænids, and gives illustrations of a "sideways attitude" or "list" in various Satyrines. It appears to be beyond doubt that a number of butterflies, especially Nymphalids, settle with their backs to the sun. The exact significance of this is not quite clear, but there appears to be no doubt that in such species as *Pararge megæra* and *Precis clelia* the diminution of the shadow when the wings are closed helps to conceal the butterflies from their enemies. The inverted position of Lycænids with the lobes of the anal angle of the hind wings resembling antennæ, suggests a "false head" at the upper hind end of the body. These insects possibly by this means perplex or alarm their enemies especially as they may wave or otherwise move in a deceptive way the false antennæ.

Genus Hæmatopota.§—Gertrude Ricardo gives a very useful account of the species of this genus in the British Museum collection. The species are conveniently grouped in zoogeographical regions, for each of which a diagnostic species-table is given, as well as numerous photographs of wings, designed to save labour in the reading of descriptions necessary for identification.

New Organ in Periplaneta Orientalis.‖—Ruth M. Harrison gives a preliminary account of an interesting glandular structure which appears to have hitherto escaped observation. It lies on the ventral side of the sixth abdominal segment, between the fifth and sixth abdominal ganglia, and opens to the exterior between the sixth and

* Brooklyn Inst. Arts and Sci., Science Bulletin, i. (1906) pp. 203–20.
† Trans. Entom. Soc. London, i. (1906) pp. 133–54 (1 pl.).
‡ Tom. cit., pp. 97–118.
§ Ann. Mag. Nat. Hist., xviii. (1906) pp. 94–127 (4 pls.).
‖ Quart. Journ. Micr. Sci., No. 198 (1906) pp. 377–82 (1 pl.).

seventh sternites. The opening is median, and from it the gland extends upwards and forwards as two distinct lobes. In the male it measures about 2 mm. in length, in the female it is very much less. Some account of its histology is given.

Insects Attacking Cocoanut Palm.*—Charles S. Banks adds to his previous account of the Coleoptera attacking the cocoanut palm a description of certain species of Lepidoptera and Coccidæ which are also injurious, e.g. the cocoanut skipper, *Padraona chrysozona* Plötz (Hesperiidæ), *Thosca cinerea marginata* Banks (Limacodidæ), and the transparent scale, *Aspidiotus destructor* Sign.

Hive-Bees Nesting in the Open Air.†—E. L. Bouvier reports the rare occurrence (two cases) of hive-bees nesting in the open air on a tree. He describes the number and form of the combs, and the fixing and protecting of the large edifice. No drone cells were seen in either case, and there was no evidence of queens being reared. Most of the workers died off in winter, and the last survivors died in early spring. Bouvier calls particular attention to the collective industry which was manifested —very effectively too—in entirely unwonted conditions.

Monograph of Coniopterygidæ.‡—Günther Enderlein gives a monographic account of this family, which has a cosmopolitan distribution. They are typical Megaloptera (Neuroptera), closely related to the Hemerobiidæ. The mealy dust on the wings and body is very characteristic; the only analogy is in the Aleurodidæ (Rhynchota). It seems likely that the dust is a secretion which hardens in the imaginal stage, and may have the same function as scales. The larvæ feed to a large extent on plant-lice. They spin a larval web on tree stems, which closely resembles a flat spider's cocoon. A systematic account of the nine genera and numerous species is given.

δ. Arachnida.

Development of Thelyphonus Caudatus.§ — W. Schimkewitsch describes the segmentation, the origin and formation of the germ-layers, and development of organs up to the time of hatching. An account of the structure of the young *Thelyphonus* is given, and some considerations bearing on the phylogenetic relations of the Arachnids are also added.

The Genus Gamasus and other Acari.‖—A. Berlese supplies a monograph upon the genus *Gamasus*, in which most of the species described have been found in Italy. Included in the memoir is a conspectus of nymphs, admittedly incomplete and provisional, but likely to be of service. In two earlier papers ¶ the same author describes a number of new Acari, one collection from Java, and another European.

* Philippine Journ. Sci., i. (1906) pp. 211–28 (10 pls.).
† Comptes Rendus, cxlii. (1906) pp. 1015–20.
‡ Zool. Jahrb., xxiii. (1906) pp. 173–242 (6 pls. and 3 figs.).
§ Zeitschr. Wiss. Zool., lxxxi. (1906) heft 1, p. 1–95 (8 pls. and 11 figs.).
‖ Redia, iii. (1905) fasc. 1, pp. 66–304 (18 pls.).
¶ Op. cit., ii. (1904) fasc. 2, pp. 154–76 (3 pls.), and pp. 231-8.

Hydrachnid Fauna of Scotland.*—W. Williamson gives a list of all the recorded Hydrachnidæ for Scotland. It would appear that these are mainly confined to the neighbourhoods of Oban, Edinburgh, Glasgow, and West Kilbride, so that this fauna does not seem to have been much worked. Fifty-four species in all are known, and of these fourteen are now recorded for the first time for Scotland.

New Pycnogonid from the Bahamas.†—Léon J. Cole describes *Barana latipes* sp. n., the only Pycnogonid obtained during an expedition to the Bahamas. The genus *Barana* Dohrn is undoubtedly very close to *Parazetes* Slater, and the two should perhaps be united.

ε. Crustacea.

Regeneration of Lost Parts in Lobster.‡—Victor E. Emmel finds that antennules, antennæ, maxillipedes, chelipeds, walking legs, first abdominal appendages, swimmerets, telson, beak, etc., may be re-grown when injured.

The thoracic appendages have a varying power of regeneration at different levels, but most at the "breaking-plane" between the second and third basal segments. As this is the region at which the limbs when injured are almost always "autotomously" severed, the comparative perfection of re-growth at this region may be the result of selection. Regenerated chelipeds of young lobsters attained a normal size at the third moult. Repeated removal of the right cheliped showed in each successive regeneration a larger percentage of difference between the lengths of the regenerated and the normal limbs. There is an adaptation of both regenerative and moulting processes to the regenerating limb, favourable to the development of a functional appendage at the first moult after injury.

Larvæ of Macrura Eucyphota.§—H. Coutière describes the curious larval forms of *Caricyphus*, *Diaphoropus*, *Hectarthropus*, *Icotopus*, and *Thalassocaris*. It seems that very diverse species have a prolonged mode of development, characterised by a uniform larval phase, much elongated, adapted to pelagic life, inherited from Schizopod ancestors, and doubtless terminating in an abrupt genital crisis, with probable reduction of size.

Antarctic Isopods.‖—Harriet Richardson discusses the Isopods collected by the French Antarctic Expedition. The collection is marked by the multiplicity of special forms, and by the gigantic dimensions of some of them. Two new genera—*Antias* and *Austrimunna*—are established.

Male of Nicothoa astaci and the Suctorial Apparatus.¶—A. Quidor has studied the insufficiently known male of this parasite of the crayfish. In the early immature stages the two sexes are indistinguishable, except

* Trans. Edinburgh Field Nat. and Micr. Soc., 1905–6, pp. 1–3.
† Amer. Nat., xl. (1906) pp. 217–22 (2 pls.).
‡ Twenty-fifth Report Inland Fisheries Rhode Island (Providence, 1905) pp. 81–117 (2 pls.).
§ Comptes Rendus, cxlii. (1906) pp. 847–9.
‖ Tom. cit., pp. 849–51. ¶ Tom. cit., pp. 465–8 (2 figs.).

by an examination of the gonads. It is suggested that the subsequent dimorphism is determined by the ethological differences. The sedentary habits of the female induce a hypertrophy of the digestive functions, impossible in the pelagic male. A minute description is given of the suctorial apparatus.

Spermatozoa of Decapoda.*—N. K. Koltzoff discusses in a very exhaustive manner the spermatozoon in Decapods as an introduction to a consideration of the problem of cell-form. There is a chapter on comparative morphology, which includes an account of the development of the various structures, nuclear and cytoplasmic, with a statement of homologies with the usual sperm type; a chapter on biophysics, in which are discussed, *inter alia*, the dependence of the external form of the Decapod sperm upon osmotic pressure, the origin of the form in histogenesis, and its fixation; a chapter on physiology, dealing with the movements of the sperm appendages, the capsule explosion, and the functions of the separate sperm "organs"; and a concluding section, treating of such matters as the significance of the central body and the mitochondria, and the organisation of the cell.

Annulata.

Collateral Budding in a Syllid.†—Akira Izuka describes in *Trypanosyllis misakiensis* sp. n. the production of numerous collateral buds at the posterior end of the body. There were fourteen sexual zooids attached to the ventral aspect of the posterior end. After full maturity the buds will evidently separate from the asexual mother individual.

Nephridia of Arenicola.‡—R. S. Lillie gives a full account of the structure, origin, and histological differentiation of the nephridia in *A. cristata* Simpson. Particular attention is given to the relation of the nephridia to the body segmentation and to the septa, and the mode of development of nephrostome, glandular portion, and terminal vesicle. There is also added a brief account of the anatomy and histology of the adult nephridium.

Heteronereis of Thames Estuary.§—H. C. Sorby gives some interesting notes regarding the *Heteronereis* of several species of *Nereis*. He has spent several months in the year for more than twenty years on the waters of the Thames estuary, and only on five occasions has he seen large numbers of *Heteronereis* swimming at the surface. Some account of these occurrences is given, and also other notes upon the following species:—*N. diversicolor*, *N. dumerilii*, *N. longissima*, *N. pelagica*, *N. cultrifera*.

Nematohelminthes.

Reducing-division in Ascaris.‖—R. F. Griggs presents evidence which seems to him conclusive that the reduction-division in *Ascaris* is

* Arch. Mikr. Anat., lxvii. (1906) heft 3, pp. 364-571 (3 pls. and 37 figs.).
† Annot. Zool. Japon, v. (1906) pp. 283-7 (4 figs.).
‡ Mitth. Zool. Station Neapel, xvii. (1905) pp. 341-405 (4 pls. and 1 fig.).
§ Journ. Linn. Soc., xxix. (1906) pp. 434-9.
‖ Ohio Nat., vi. (1906) pp. 519-27 (1 pl.).

a true reducing-division in Weismann's sense. In *Ascaris megalocephala bivalens* the tetrads arise, not by a double longitudinal split of the original spirem-thread, but by a folding of adjacent segments together (conjugation of univalent chromosomes) along with what is believed to be a single longitudinal split. The two split loops which form the two tetrads appear very early in the continuous spirem, and in their later development simply break apart, shorten, thicken, and straighten out till the tetrads are formed.

Since of each tetrad only one component chromosome remains in the ripe ovum, there is a reducing-division in Weismann's sense, by which paired chromosomes are separated from each other in the egg, and the hereditary characters transmitted by the chromosomes thereby modified.

Anatomy of Nematodes.*—F. H. Stewart describes in some detail the anatomy of *Oncholaimus vulgaris* Bast., a free-living Nematode, and gives some notes on the reproductive system of *Ascaris clavata* and on the excretory gland in the larva of an *Ascaris* from the cod. Of special interest are the observations on the cœlom. The cavities containing the testes and ovary are true gonocœls or protocœloms. In the forms described a series is made out. In the immature female or mature male of *O. vulgaris* there is a simple gonocœl; next in the mature female the gonocœl is slightly more complex; there is a narrow conical outgrowth from the original cavity, which is represented by the ovarian cæcum; finally in *A. clavata* the entire gonocœl has become enormously elongated and convoluted. The call for this latter development is the need for an enormous increase in the reproductive products on changing from a free to a parasitic life.

Platyhelminthes.

Structure and Development of Cysticercus.†—H. Schaaf discusses, with particular reference to *Tænia solium*, the structure and development of cysticerci, of which he has had abundant material of different ages. The cysticerci of *T. serrata*, *T. saginata*, and *T. marginata* are also described.

Echinoderma.

Growth of the Oocyte in Antedon.‡—G. C. Chubb has endeavoured to interpret in terms of the cell-metabolism the structural changes exhibited by the growing ovarian ovum of *Antedon bifida* Penant.

Throughout the whole growth of the oocyte the nucleolus intermittently discharges groups of deeply basophile spherules into the cytoplasm. In the young oocyte these "nucleolar spherules" accumulate in the cytoplasm, where they form small groups near the germinal vesicle. In slightly older oocytes the increased fluidity of the cytoplasm which results from the progressive accumulation of metaplastic material in preparation for yolk-formation, causes the discharged nucleolar substance to lose its spherular form, and to diffuse on the neighbouring cytoplasm. The more deeply staining area of the cytoplasm to which

* Quart. Journ. Micr. Sci., No. 197 (1906) pp. 101–50 (3 pls.).
† Zool. Jahrb., xxii. (1906) heft 3, pp. 435–76 (2 pls. and 13 figs.).
‡ Proc. Roy. Soc. London, Series B, lxxvii. No. B 519, pp. 384–7.

this diffusion gives rise is the yolk-nucleus. As the cytoplasm becomes still more fluid, the yolk-nucleus becomes a concavo-convex lens embracing the spherical germinal vesicle. The yolk-nucleus is simply a region of the cytoplasm on to which waste material discharged from the nucleolus has diffused, and its subsequent movement to the periphery and its other changes are all determined by the progressive change in the physical consistence of the cytoplasm which precedes and accompanies yolk-formation.

The spherical form of the nucleolus, a form in which minimum surface area is associated with maximum bulk, stands in striking contrast to the subdivided condition of the chromatin, and indicates the absence of any reaction between the caryolymph and the nucleolar substance at the surface of the nucleolus; the latter structure passively growing by the deposition of material on its surface from solution in the caryolymph.

The nucleolar material consists of two substances: the one acidophile and extending throughout the nucleolus, the other deeply basophile and borne by the acidophile ground substance, to which its presence imparts a considerably firmer consistence. Nucleolar activity, which proceeds from within outwards, results in the breakdown of the basophile constituent, the products of which are eventually discharged into the caryolymph. On the completion of yolk-formation all indication of nucleolar activity abruptly ceases. The supply of the basophile constituent of the nucleolus also ceases, but the acidophile constituent continues to be deposited on the nucleolar surface, where, no longer being incorporated by the now inactive nucleolus, it forms lens-shaped accumulations. The acidophile constituent is probably due to the chromatin, the basophile to the cytoplasm. The steady growth of the nucleolus is not due to the accumulation of waste material, but to an increased production of the "ground substance" by the chromatin in order to cope with the ever-increasing production of waste material by the cytoplasm of the growing egg. From the nucleolus this waste material, now presumably inert and harmless, is discharged into the cytoplasm, where it slowly dissolves away.

As metabolism increases, the chromatin is more sub-divided; this facilitates reaction with the surrounding caryolymph, and indicates that the chromatin obtains its food-material by active incorporation. The source is outside the cell, and the chromatin is the cell-structure with which the raw food-material supplied by the parent organism first comes into relation. The elaborated food-material is passed on from the chromatin, in part to the nucleolus, but mainly to the cytoplasm. During the period preceding yolk-formation, which is marked by the progressive accumulation of metaplastic material in preparation for this process, the avidity with which the cytoplasm takes up the products of chromatin activity causes the latter structure to appear faintly stained. With the commencement of yolk-formation this avidity is greatly reduced, and the products of chromatin activity, now being produced in excess of the requirements of the cytoplasm, accumulate on the chromatin threads, causing the increase in the staining capacity of the latter and the formation of the basophile droplets.

Throughout the whole growth-period of the oocyte there is a gradual

accumulation in the cytoplasm of metaplastic material in preparation for yolk-formation. This is accompanied by an increase in the basophile staining capacity and fluid consistence of the cytoplasm. The process of yolk formation, that is the actual appearance of the definitive yolk-spherules, is unaccompanied by increased nuclear or nucleolar activity, and consists simply in the rapid and automatic conversion of the accumulated material into a form sufficiently stable to survive the period of quiescence which succeeds the completion of the growth of the egg.

The oocyte constitutes an osmotic system, of which the cell-wall forms an outer, the nuclear membrane an inner semi-permeable membrane. The accumulation in the cytoplasm of soluble substances in preparation for yolk-formation causes an increase in the osmotic intensity at the outer membrane, and a corresponding decrease of that at the inner. The loss of turgescence which thus results permits of the assumption of an irregular form during fixation.

Up to the expansion due to the formation of the definitive yolk-spherules, the size of the germinal vesicle shows a close relation to that of the egg, and is determined when equilibrium is established between the rate of diffusion of nutritive substances through the nuclear membrane on the one hand, and the requirements of the chromatin on the other.

Nervous System of Asteridæ.*—R. Meyer deals with the finer structure of the nervous system in Asteridæ, describing the radial system, the cuticula, the covering or support cells (Stützzellen), gland-, sense-, and ganglion-cells in *Asterias rubens*. With reference to the "enterocœl nervous system," described by Cuenot, as existing in the dorsal peritoneal epithelium in *A. glacialis* and other starfish, the author expresses doubt. He failed to find it in *A. rubens*, and points out that Cuenot himself could not observe it in *Asterina*. On account of these facts he is inclined to question the existence of an enterocœl nervous system.

Cœlentera.

Sexual Dimorphism in Aglaophenia.†—H. B. Torrey and Ann Martin find that, in those species bearing both closed and open corbulæ which they have examined (*A. diegensis* Torrey, *A. pluma* (Linn.), *A. stouthionides* Murray, and *A. inconspicua* Torrey), the female gonophores are contained solely in those corbulæ which have completely fused leaflets (closed); the male in those where the leaflets are more or less free from one another (open). They therefore consider it highly probable that other species of *Aglaophenia*, and perhaps even other genera, may show sex characters of a similar nature in their phylactocarps.

Structure of Isis Hippuris.‡—J. J. Simpson, in view of the fact that the genus *Isis* has hitherto been but imperfectly described and

* Zeitschr. wiss. Zool., lxxxi. (1906) heft 1, pp. 96–144 (2 pls.).
† Univ. California Publications (Zool.) iii. No. 4 (1906) pp. 47–52 (9 figs.).
‡ Journ. Linn. Soc., xxix. (1906) pp. 421–33 (1 pl.).

insufficiently known, gives a precise detailed description of this species, which is also the sole representative of a distinct family. The previous literature of *Isis* is reviewed, and a note of its distribution as far as recorded is given.

Porifera.

New Clionid.*—E. Topsent describes *Cliothosa seurati* g. et sp. n., a new boring sponge, from the Gambier Islands. There are no somatic microscleres, and the choanosomic asters are amphiasters.

Protozoa.

Biometrical Study of Conjugation in Paramœcium.†—R. Pearl has made a study of variation and correlation in conjugating and non-conjugating examples of *Paramœcium caudatum*. The author's aim has been to determine whether the portion of the *Paramœcium* population, which is in a state of conjugation at a given time, is differentiated in respect of type or variability, or both, from the non-conjugating portion of the population living in the same culture at the same time; and further whether there is any tendency for like to pair with like ("homogamy"), and if so, how strong this tendency is. The results showed that there is a differentiated "conjugant type" of *Paramœcium*; and that this "conjugant type" is relatively fixed and constant under varying environmental conditions, as compared with the general population in fission generations. Thus it follows that if the individual *Paramœcia* of a given race must conform to a definite and relatively fixed morphological type every time they conjugate, what they may acquire during fission generations is clearly of no particular account to the evolutionary history of the race in the long run.

Rhizopoda in Human Spinal Fluid.‡—V. Ellermann describes from the spinal fluid in two cases of poliomyelitis acuta, rhizopods showing a well marked development of filose pseudopodia. They bore no resemblance to polynuclear leucocytes, but were quite characteristic. No bacteria were found associated with them.

Trypanosome of Horse.§—J. J. Vassal describes a trypanosome affecting horses in Annam. Laveran and Mesnil‖ have conducted a series of immunity experiments with a view to determining its relation to the organism of Surra, which it resembles. Their main conclusion is that it is probably a variety of the same; it is not distinct from Surra in the sense that Nagana is.

Spirillum of Bat.¶—C. Nicolle and C. Comte describe a fatal spirillum disease of *Vespertilio kuhli* from Tunis. The source of infection is apparently undetermined.

* Bull. Mus. Nat. Hist., 1905, pp. 94–6.
† Proc. Roy. Soc., Series B, lxxvii., No. B 518, pp. 377–83.
‡ Centralbl. Bakt. Parasit., xl. (1906) heft 5, pp. 648–53 (1 pl. and 1 fig.).
§ Ann. Inst. Pasteur, xx. (1906) pp. 256–95.
‖ Tom. cit., pp. 296–303. ¶ Tom. cit., pp. 311–20 (1 pl.).

Myxosperidium of Trout.*—L. Léger gives a brief account of *Chloromyxum truttæ* sp. n., occurring in the gall-bladder of *Trutta fario* L. at Dauphiné. It closely resembles *C. fluviatile*. The hosts suffer from enteritis, the liver is discoloured, and the gall-bladder enormously distended. The fins and all clear parts of the skin turn yellow, there is marked emaciation, and death usually results. The parasites, which live free in the gall-bladder and its ducts, have been found only in sickly trout.

* Comptes Rendus, cxlii. (1906) pp. 655–61.

BOTANY.

GENERAL,

Including the Anatomy and Physiology of Seed Plants.

Cytology,

including Cell-Contents.

Cytology of Nectar-Glands of Vicia Faba.*—C. Stockard has examined the nectar-glands on the stipules of *Vicia Faba*, and finds that they contain rows of cells, the contents of which have different chemical reactions, shown in life by different colours; these are probably due to differences in metabolic activity. The colour response resembles that of litmus, acids turning the cell-contents red, and bases turning them blue. When young the gland-cells differ but slightly from ordinary cells. The nuclei are granular, sometimes coarsely vacuolated, with one or more plasmosomes surrounded by vacuoles; they are spherical when young, but later on are shrunken and irregular. They are generally central, and probably give out material to the cytoplasm which ultimately gives rise to granules. Rarely the nucleus loses its chromatin and takes plasma stains. During secretion the cytoplasm first becomes vacuolar, then slightly granular, and takes nuclear stains. These changes are controlled by the nucleus which seems to be the centre of metabolic activities, sharing in the formation of the secreted substance, but taking no part in the actual process of secretion.

Structure and Development.

Vegetative.

Investigations on the Anatomy of Allied Plants.†—A. Sarton has tested the constancy of anatomical characters under varying conditions of soil and climate. He calls attention to two kinds of species, viz., Linnæan and Jordanian, which vary according to the different values placed upon external morphological characters. The author believes that where the anatomical differences of allied species are experimentally interchangeable, such species should not be regarded as distinct, however unlike may be their external appearance. On the other hand, those whose anatomical differences are constant under experiment are true species, though agreeing in their external appearance. The chief value of this investigation is in the evidence as to what anatomical characters vary under given conditions.

Physiology.

Nutrition and Growth.

Chlorosis in Malvaceæ.‡—Baur has investigated the infectious chlorosis of the Malvaceæ, using for his experiments *Abutilon striatum*,

* Bull. Torrey Bot. Club, xxxiii. (1906) pp. 247–62 (2 pls.).
† Ann. Sci. Nat. (Bot.), sér. 9, ii. (1905) pp. 1–117 (4 pls.).
‡ SB. Akad. Wiss., 1906, pp. 11–29.

a plant capable of transmitting its variegation by grafting. He finds that if the leaves are removed from variegated plants, and the plants are then kept in the dark, new shoots appear with only two or three variegated leaves, and if the latter are removed the plant remains permanently green, unless infected afresh by grafting. If latent axillary buds on old parts are forced into growth they produce variegated leaves, which infect all the rest of the plant. If all variegated leaves are removed and the plant exposed to light, it becomes permanently green. Similar results were obtained with *A. arboreum*. The author believes that the variegation is caused by a virus formed only in the light in the affected parts of the plant; also that this virus is formed only in small quantities, which are quickly used up if the infected leaves are at once removed. It is only able to infect embryonic leaves, and is then stored for months in an inactive form. Experiments show that the virus moves in the cortex and not in the transpiration current. When variegated *A. Thomsoni* is grafted with immune *A. arboreum*, the scions grow well but are not infected, although if these scions are themselves grafted with a susceptible species, the virus passes through the immune parts and infects the susceptible species. This virus may thus be compared to the supposed shoot-forming substance of Sachs and the growth-enzymes of Beijerinck.

Starch in the Bryophyta.*—El. and Em. Marchal have carried out a series of physiological researches on the presence of starch in hepatics and mosses. In the first chapter they describe in detail their experiments made upon some 50 hepatics and 90 mosses, to determine the existence and localisation of starch in them. Their first list is systematic. For convenience they then class the species in three groups according to whether they contain much, little, or no starch. In the first group are 27 hepatics and 52 mosses; in the second, 12 hepatics and 24 mosses; in the third, 11 hepatics and 14 mosses. Types of the first group, where freshness is constant, are *Cincinnulus trichomanis*, *Atrichum undulatum*; types of the second group, exposed to short and rare periods of desiccation, are *Lophocolea bidentata*, *Ceratodon purpureus*; types of the third group, adapted to withstand prolonged desiccation, are *Radula complanata* and *Neckera crispa*. In the second chapter they consider the effect of light, heat, water, and nutritive solutions upon the production and fluctuation of the stores of starch, and find that the Muscineæ react in precisely the same way as do the chlorophyllose Phanerogams.

Direction of Growth in Hepatics.†—B. Nemec has been studying the direction of growth of the sporogonium and vegetative shoots of certain hepatics in darkness both under the action of gravity and freed from it. Varied results were obtained. The plants examined were *Lophocolea bidentata*, *Lejeunea serpyllifolia*, *Aneura pinguis*, *Pellia calycina*, and *P. epiphylla*. Most of these were geotropic, and grew orthotropically or plagiotropically upwards in the dark; but the first two species were ageotropic.

* Bull. Soc. Roy. Bot. Belgique, xliii. (1906) pp. 115–214.
† Flora, xcvi. (1906) pp. 409–50 (9 figs.).

Respiration in Leaves attacked by Peronospora.*—L. Pavarino finds that normal respiration is accelerated by the presence of *Peronospora* in the tissues; the absorption of oxygen is increased. Intra-molecular respiration is more active in diseased leaves, but it becomes exhausted, while it continues in healthy leaves. He finds also an increased quantity of oxydase not only in leaves invaded by a parasite but also in wounded leaves. This is due, he considers, to the reaction of the protoplasm against the parasite or the poisonous substances excreted by it. The experiments were made on vine-leaves.

TERRY, O. P.—**Galvanotropism of Volvox.**
Amer. Journ. of Physiology, xv. (1906) pp. 235–44.

General.

Graft Hybrids.†—Noll, having examined the graft-hybrids resulting from grafting *Mespilus germanica* upon *Cratægus monogyna*, is of the opinion that they originate through nuclear fusion in the callus. The cells of the hybrid branches have not double the sporophyte number of chromosomes, so that if these branches arose from fusion of two vegetative cells, there must have been some method of reduction. The greater resemblance of the hybrid to the stock or scion is explained by the assumption that in each fusion the nucleus which moved into new cytoplasmic surroundings was so weakened that in the reduction process it contributed fewer determinants than did the stationary nucleus to the hybrid nucleus. The author hopes to succeed in recreating the hybrid *Laburnum Adami*, which is said to give similar results.

Nectaries of Cruciferæ.‡—Armando Villani finds that the nectaries of Cruciferæ are referable to one primitive type, viz., two at the base, external to each stamen, constituting a dimerous, external whorl, and two at the base, and between each member of each pair of long stamens, constituting an internal dimerous cycle. The author thinks that the Cruciferæ may be divided into types and generic groups according to the number and position of their nectaries. He regards the whole flower as dimerous, the tetramery of the corolla being only apparent.

Variation of Flowers.§—G. Klebs, as a result of experimental work on the variations of flowers, offers a substitute for De Vries's intracellular pangenesis. He is convinced that all variations are due to the influence of external factors upon the inherent potentialities of the organism, and has made use of various conditions of temperature, darkness, wounding, and artificial food, using *Campanula Trachelium* and *Sempervivum Funkii* for his experiments. He shows that the taxonomic limits of a given species are easily passed if external conditions favour the expression of potentialities inherent in the organism. The influence of external conditions is much greater before inception of the organs than after. He

* Atti Ist. Bot. Pavia, xi. (1906) p. 16. See also Bot. Centralbl., cii. (1906) pp. 38–9.
† SB. Niederrhein Ges. Nat. u. Heilkunde, Bonn (1905). See also Bot. Gaz., xli. (1906) pp. 358–9. ‡ Malpighia, xix. (1906) pp. 399–439.
§ Jahrb. wiss. Bot., xlii. (1906) pp. 155–320 (1 pl.).

regards a species as characterised only by its constant relation to the outer world, or in other words, as comprising all individuals which have arisen by vegetative reproduction or self-fertilisation, and showing identical characters for many generations. The potentialities of Klebs are immaterial as compared with the pangens of De Vries, which are material and carry the unit characters.

Preserving Plants.*—G. Pollacci finds that plants preserved in a weak solution of sulphur-dioxide retain their form and are kept in good condition for sectioning. The colour may be preserved by immersion in an aqueous solution of copper-sulphate before being placed in the preservative.

CRYPTOGAMS.

Pteridophyta.

(By A. Gepp, M.A., F.L.S.)

North American Ferns.—A. B. Klugh † gives a list of 79 ferns which form the fern-flora of Ontario. He records the stations at which they have been found, and briefly describes the geological characters of the province, and the mean yearly temperatures of its counties. L. H. McNeill ‡ gives an account of *Botrychium biternatum*, a rare species found in the neighbourhood of Mobile, Alabama, and relates how it was pointed out to him about 30 years ago by the late Dr. Charles Mohr, in a spot now covered with buildings. On searching for the plant two years ago, he re-discovered it in two places. He describes the manner of growth of the plant, the kind of habitat which it prefers, and the characters which satisfy him that it is a distinct species not to be confounded with *B. obliquum*. W. Palmer, § discussing the occurrence of green and red stiped lady ferns in North America, requests botanists to help him in defining the geographical distribution of the two forms, and in ascertaining whether the form with green stipe is boreal and the red austral. W. N. Clute ‖ describes the distribution of *Botrychium Lunaria* in North America, and gives his reasons for the opinion that *B. onondagense* cannot be separated from it specifically. E. L. Lee ¶ gives an account of a hidden shaded nook in the Cumberland mountains near South Pittsburg, Tennessee, the only recorded station for *Scolopendrium* in the south, and suggests that the apparent rarity of the plant may be due to the secluded nature of its haunts. G. E. Davenport,** writing on the forms of *Botrychium simplex*, points out that the fully matured form of the plant is Lasch's var. *compositum*, of which that author described a binate and a ternate form; that this variety bears the lamina low down near the base of the frond, while Milde's var. *fallax* bears the lamina above the middle of the frond. W. N. Clute †† continues his check list of the North American fernworts. Mrs. J. R. Sanford ‡‡

* Bull. Soc. Bot. Ital., 1905, p. 242.
† Fern Bulletin, xiv. (1906) pp. 65–74.
‡ Tom. cit., pp. 74–6.
§ Tom. cit., pp. 78–9.
‖ Tom. cit., pp. 80–1 (1 pl.).
¶ Tom. cit., pp. 82–4.
** Tom. cit., pp. 84–5.
†† Tom. cit., pp. 86–90.
‡‡ Rhodora, viii. (1906) pp. 113–14.

describes how she found a likely spot in Massachusetts for the reputed hybrid *Asplenium ebenoides*, the soil being favourable, and the two ferns *Asplenium ebeneum* and *Camptosorus rhizophyllus* present in plenty, and after a short search discovered *A. ebenoides* (a new record for Massachusetts), and close by it a variant form of *C. rhizophyllus* verging towards *A. ebenoides*.

South American Ferns.—G. Hieronymus* gives the first instalment of his enumeration of the ferns collected by Dr. A. Stübel in 1868 during his geological explorations in Columbia, Ecuador, Peru, and Bolivia. Though not a botanist, Stübel made the best use of his exceptional opportunities for collecting from the plains right up to the eternal snows, his object being to bring back specimens typical of the various zones visited by him; and his collection was at the time by far the best ever made in that region. Eight new species are described and figured, six of them belonging to the genus *Alsophila*. P. Dusén,† in his account of the flora of the Serra do Itatiaya in Brazil, gives a list of 26 Pteridophytes collected by him during his expedition in May–July 1902, on behalf of the National Museum at Rio de Janeiro. The specimens were almost all determined by H. Christ. H. Christ ‡ publishes a list of 28 Brazilian ferns collected by J. Huber and Madame A. Goeldi for the Goeldi Museum at Para, during an expedition to the frontier of Peru, up the river Purus, an important tributary of the Amazons. The collection shows no trace of a sub-andine character, but is of the type found over the great Brazilian plain. Four new species are described.

Japanese Ferns.§—J. Matsumura publishes an index of Japanese plants with the species arranged alphabetically under their classes. The habitat, Japanese name, citations of literature, synonyms, and a bibliography are added. The Pteridophyta are 621 in number, including 25 fossil ferns.

Norfolk Island Ferns.‖—J. H. Maiden, in his account of the flora of Norfolk Island, publishes a list of 55 species of Pteridophyta with critical notes on doubtful points, synonymy, etc. Six of the species appear to be new records for the island.

Rare Form of Asplenium Ruta-muraria.¶—R. Pampanini discusses "*lusus depauperatum* Rosenstock," a monstrous form of *A. Ruta-muraria* described by Christ in his monograph of the many variations of the species.** The original plant was found near Castelruth in South Tyrol, and Pampanini has obtained further specimens from the sub-alps of Belluno. He describes the plant, and calls attention to its peculiarities, the lanceolate form of the leaves, the linear lacineæ, the marginal sori, and the longly ciliated indusium—these are but exaggerations of what occurs in other forms of the species; and despite its very distinct external appearance, *depauperatum* must not be mistaken for some other

* Hedwigia, xlv. (1906) pp. 215–38 (4 pls.).
† Arch. Mus. Nacion. Rio de Janeiro, xiii. (1903) pp. 105–9.
‡ Hedwigia, xlv. (1906) pp. 190-4.
§ Index Plantarum Japonicarum. Tokio: Maruzen, 1904, i. pp. 284–363, 382–96.
‖ Proc. Linn. Soc. New South Wales, xxviii. (1903–4) pp. 729–40.
¶ Nuov. Giorn. Bot. Ital., xiii. (1906) pp. 229–35 (1 pl.).
** Hedwigia, xlii. (1903) p. 170.

species, nor even for a hybrid. The indusium of *A. Ruta-muraria* is one of the most typical characters of the species; it is longly ciliate. And yet, curiously enough, authors have described it so diversely as erose, denticulate, lacerate, fimbriate, etc. (scores of citations are given in foot-notes); and in their figures they have almost all either omitted it or represented it as entire, crenulate, eroso-lacerate, denticulate, or very shortly ciliate. Pampanini has, by numerous observations, determined it to be more or less longly ciliate at first, the cilia equalling the width of the undivided part of the indusium or even being twice as long. After maturation of the spores, the cilia break off, and the membrane becomes lacerate. Figures are given.

How Ferns Grow.*—M. Slosson, in her freely illustrated book "How Ferns Grow," points out the principal features of the development of form and venation in fronds as seen in the ferns of the North-Eastern United States. Eighteen species are treated, each in a chapter by itself, containing a description of a mature plant followed by a detailed account of the evolution of the fronds from the earliest simple form of the first year, to the fully developed frond of a mature plant. Sufficient examples of these often strangely diverse stages occurring in one and the same species are well represented by photography in the plates.

Structure of Tree-Ferns.†—W. Schütze treats of the physiological anatomy of some tropical ferns, especially the tree-ferns. He gives a brief summary of such little work as has been done on this neglected subject, and attempts to supply in this paper such information as botanists require. His material comprises the genera *Cyathea*, *Alsophila*, *Hemitelia*, and *Dicksonia*, and also *Lygodium* and *Drimoglossum*. First he treats of the epidermis, the corky sub-epidermal layers, and epidermal structures. Passing on to the vascular tissue, he describes the form and course of the main bundle, of the medullary and cortical bundles, the hadrome and protohadrome, tylosis, the leptome and protoleptome, the parenchyma sheath and endodermis, the external parenchyma. He then deals with the mechanical system, its structure and arrangement, the mechanical cells, the brown colouring-matter in the walls of the un-lignified stereome-cells; and concludes with remarks on the secretory system and the stores of excreted matters.

Bud-formation on Fern-leaves.‡—W. Kupper treats of the formation of buds on certain fern-leaves, especially *Adiantum Edgeworthii*. In this and some seven other species apical buds occur. He discusses the various modes of development of the buds in relation to the leaf-apex. The bud-bearing leaves usually are prolonged at the apex, so that the bud is made to touch the earth and takes root as an independent plant. The author describes the various modifications of the first leaves of the buds formed by the different species. In *Trichomanes pinnatum* buds are produced on each side of the lengthened rachis in place of pinnæ, and arise like these from marginal cells. In *Asplenium obtusilobum* and

* New York: Henry Holt, 1906, viii. and 156 pp., 46 pls.
† Beitr wiss. Bot., v. (1906) pp. 329–76 (figs.).
‡ Flora, xcvi. (1906) pp. 337–408 (figs.).

A. Mannii normal and bud-bearing pinna-less leaves arise in alternation; in *A. Mannii*, the buds arise from marginal cells, and in *A. obtusilobum* from the upper surface. In both these species the elongated rachis is therefore monopodial with theoretically unlimited growth; and in *A. obtusilobum*, if the apex of this rachis is cut off the first leaf-rudiment of the youngest bud becomes converted into a continuation of the proliferous apex. The author then gives a list of numerous ferns grouped according to the positions occupied by the buds on the leaves.

Systematic Value of Sporangium-wall.*—K. Schnarf adds to our knowledge of the structure of the sporangial-wall in Polypodiaceæ and Cyatheaceæ, and discusses its systematic importance. He gives a brief account of the use made by previous authors of the taxonomic characters afforded by the sporangia, and expresses his opinion that the sporangia of the Leptosporangiatæ afford sufficient characters for a natural division of the ferns, but that the annulus by itself is not enough, being influenced by external factors; yet in combination with the structure of the sporangial-wall it affords ample material for establishing the natural relationships of the ferns. He describes in detail the structure of the sporangium in all its parts, selecting *Blechnum* as a typical example. Applying his ideas to *Asplenium*, he gives a list of many species examined by him and arranged in five sections by Diels, and finds that they are all characterised by similar sporangial characters, but that *Diplazium* and *Athyrium* are entirely different, while *Ceterach*, *Scolopendrium*, and *Pleurosorus* entirely agree with *Asplenium*. Other botanists have reached the same conclusion in other ways. Similarly in Cyatheaceæ the author's theory holds good, but is more difficult of application; and he discusses the question as to whether *Dicksonieæ* and *Cyatheæ* ought to be united in one family.

Gold and Silver Ferns.†—W. Zopf publishes an account of some experiments on the coloured secretions of the gold and silver ferns, *Gymnogramme chrysophylla*, *G. sulphurea*, *G. calomelanos*. By dipping the fronds for an instant into neutral purified ether, he readily dissolved these secretions, and obtained them in a pure state by distilling off the ether. From the yellow secretion of *G. chrysophylla* and *G. sulphurea* he isolated two substances—a chrome-red crystallising aromatic body, which melts at 159°, $C_{18}H_{18}O_5$, and a neutral wax, which melts at 63°. From *G. calomelanos* he obtained a colourless, crystallising body, with a camphor-like smell, and melting at 141°, $C_{20}H_{22}O_6$. They are not fatty substances, nor are they resinous. Whether the wax comes from the glands or from the epidermis, he has been as yet unable to determine.

Tracheids in Node of Equisetum.‡—M. G. Sykes has experimented upon the tracheids found in the nodal region of *Equisetum maximum*, and shows that their function is the conduction of water from the canals of the internode on one side of the node to those of the internode on the other side. This was demonstrated by forcing a solution of eosin

* SB. k. Akad. Wiss. Math. Nat. Wien, cxiii. (1904) pp. 549–73 (1 pl.).
† Ber. Deutsch. Bot. Gesell., xxiv. (1906) pp. 264–72.
‡ New Phytologist, v. (1906) pp. 129–32 (figs.).

along a stem under atmospheric pressure, and then cutting sections to ascertain the route followed by the solution.

Germination of Ophioglossum.* — D. H. Campbell describes the germination of the spores of *Ophioglossum moluccanum*, *O. intermedium*, and *O. pendulum*, and the earliest stages of growth up to the formation of four, three, and thirteen cells respectively.

Structure of Stolons of Nephrolepis.† — A. Sperlich describes the function and behaviour of the stolons of *Nephrolepis cordifolia*, and states that the secondary stolons are positively geotropic and throw out roots, but may be converted into aerial stolons by decapitation of the primary stolons. These secondary stolons he would style "wurzelträger" (root-bearers). The first rudiments of the stolons are formed at the growing point, and many of them remain dormant. The roots also are first traceable at the growing point in the initial layer, whence are derived the parenchyma and endodermis. The structure of the aerial and rooting stolons is similar, except that in the former the cortical tissue retains its living condition to a distance of as much as some decimetres behind the apex, being chlorophyllose, and provided with intercellular spaces connected with stomata. The tough, elastic character of the stolons is due to a sub-epidermal sheath of 6–7 layers of lignified cells. The rooting and aerial stolons form a canal-system, protected from crushing and from desiccation. The author compares them with the rhizophores of *Selaginella*.

Past History of Ferns.‡ — E. A. N. Arber discusses the past history of the ferns in the light of recent discoveries, and sums up his main results in a diagrammatic figure, which shows the geological periods during which the Cycadophyta, Cycadofilices, Primofilices, Leptosporangiatæ, Hydropterideæ, and Eusporangiatæ, respectively attained to the position of dominant factors. The name Primofilices is suggested for the ancient stock from which the Mesozoic Leptosporangiatæ were derived. Recent research tends to show that the fern-like fructifications, formerly regarded as belonging to the Eusporangiate ferns of Palæozoic times, are the male organs of Pteridosperms. Hence, it can no longer be held that the Eusporangiatæ were a dominant group in Palæozoic times, nor that they constitute a more primitive type than the Leptosporangiatæ. The Hydropterideæ are but doubtfully represented in Mesozoic times, and hence are the youngest group considered in the paper.

Parichnos.§ — T. G. Hill discusses the presence of a parichnos in recent plants. Having briefly summed up the results obtained in *Lepidodendron* and other fossil plants by previous workers, he suggests that the seeming discrepancies that are obvious in the various accounts and figures may be explained simply by the view that the parichnos has been preserved in different stages of development, varying from a definite

* Ann. of Bot., xx. (1906) p. 321.
† Flora, xcvi. (1906) pp. 451–473 (2 pls.).
‡ Ann. of Bot., xx. (1906) pp. 215–32 (fig.).
§ Tom. cit., pp. 267–73 (2 pls.).

parenchymatous strand to the final stage of disintegration—an open canal. Starting from the middle cortex it bifurcates, forming two branches situated on each side of the foliar bundle. He then describes the investigations made by himself and others upon the presence of a parichnos in recent plants—*Isoetes* and *Lycopodium*—and shows its identity with that of fossil plants. The parichnos of recent plants is primarily concerned in the production of mucilage. In fossil plants it has been held to represent a glandular tissue, a gum-canal, a transpiratory or respiratory organ, comparable to the function of lenticels. It is possible that its function was at first secretory, and subsequently, after the leaves had been shed, it became respiratory.

Lepidodendron obovatum.*—D. H. Scott describes a specimen of this fossil plant obtained from the Lower Coal-measures at Towneley, which presents the rare feature of permitting its anatomical structure to be investigated, while by its external characters it allows its specific identification to be established. But for its superficial characters, it would, from its anatomy, have been placed in *Lepidophloios*, its stem structure being in close agreement with that of *L. fuliginosus*. Identifications of *Lepidophloios*, based solely on anatomical features, are, therefore, open to suspicion.

Megaspore of Lepidostrobus.†—R. Scott describes and figures instances of a curious structure, forty examples of which she observed when revising 1500 slides of fossil plants from the Coal-measures. It has the appearance of a crumpled megaspore, with an appendage attached to it. Similar structures were found in 25 out of 36 slides of *Lepidostrobus foliaceus*; and finally, a good instance of it in Williamson's type cone of that species. That cone had previously been regarded as purely microsporangiate; it is now shown to be heterosporous.

CHRISTENSEN, C.—**Index Filicum.** (Index of Ferns.)
[Continuation of the alphabetical enumeration of species and synonyms from *Polystichum aculeatum* to *Trichomanes gibberosum*.]
Copenhagen: Hagerup, 1906, fasc. x., pp. 577–640.

Bryophyta.

(BY A. GEPP.)

Classification of Mosses.‡—V. F. Brotherus, in parts 224 and 226 of Engler and Prantl's "Die natürlichen Pflanzenfamilien," treats of the moss-families Spiridentaceæ, Lepyrodontaceæ, Pleurophascaceæ (represented by a single genus containing only one species, which is confined to the western mountains of Tasmania), and Neckeraceæ. The latter family is sub-divided into ten sections, rich in genera and species. The narrative breaks off in Lembophyllaceæ.

New British Mosses.§—L. J. Cocks gives an account of a moss found by him on Ben Lawers on July 15, 1902, and referred by him to

* Ann. of Bot., xx. (1906) pp. 317–19.
† New Phytologist, v. (1906) pp. 116–19 (plate and figs.).
‡ Leipzig: Engelmann, 1906, pp. 769–864 (58 figs.).
§ Journ. of Bot., xlv. (1906) p. 242.

Mnium medium, on account of its synoicous inflorescence. In this conclusion he is confirmed by Dr. Hagen, who points out that the specimen possesses all the more stable characters of the species—structure of stem and nerve, form of leaf, and structure of leaf-teeth, which, near the basal margin, consist sometimes of one, sometimes of two cells; and shows how the Ben Lawers specimen differs from other species—e.g. *M. affine* and *M. cuspidatum*. The species is an addition to the British flora, and, curiously enough, *Hypnum turgescens*, another addition to our flora, was gathered on the same day upon Ben Lawers.

New Plagiochila from Ireland.*—F. Stephani describes and figures two new species of *Plagiochila* from Killarney—*P. Owenii* and *P. killarniensis*. The latter was published and figured last year by W. H. Pearson,† but Stephani has discovered further details which require explanation. He also publishes new names for three exotic species of *Plagiochila* described in his monograph of the genus in his Species Hepaticarum.

Worcestershire Mosses.‡—J. B. Duncan enumerates seven mosses which are additions to J. E. Bagnall's Worcestershire moss list published in 1903. One of these is *Amblystegium compactum*, which in Britain had previously been recorded only from damp calcareous stations in Sutherlandshire and Derbyshire; it has now been demonstrated to occur on dry, slightly calcareous, triassic sandstone in Worcestershire. Another unexpected record is *Andreæa Rothii* on similar sandstone only 200 feet above sea-level. New stations for five previously recorded species are added.

Yorkshire Bryophyta.§—W. Ingham gives a list of 44 hepatics growing around York within a circle of 20 miles radius. At a somewhat greater distance are found *Petalophyllum Ralfsii*, *Pallavicinia Flotowiana*, *Scapania subalpina*, *S. rosacea*, and *Jubula Hutchinsiæ*. Of the Sphagnaceæ he gives lists with field-notes for Skipwith and Strensall Commons, and other localities. For the mosses he describes the habitats in which several species and varieties are found on Skipwith Common and Jackdaw Crag Quarry, and adds a list of 112 of the less common species occurring within 20 miles of York.

North American Bryophyta.‖—C. C. Haynes gives a list of 48 hepatics collected near Little Moose Lake, in the Adirondacks; and A. M. Smith a list of 103 mosses from the same district. B. D. Gilbert¶ publishes notes on two anomalies: first, *Leucobryum glaucum* growing in spheroidal cushions entirely unattached, as it often does in this country; and, secondly, a fine growth of *Sphagnum acutifolium* var. *quinquefarium* on a steeply-inclined bare rock kept moist by a slight trickle of water. A. J. Grout ** issues Part III. of his "Mosses with Hand-lens and Microscope," giving a richly illustrated and rather

* Hedwigia, xlv. (1906) pp. 213-14.
† Journ. of Bot., xliii. (1905) p. 281. ‡ Op. cit., xliv. (1906) pp. 243-4.
§ Handbook to Brit. Assoc., York, 1906, pp. 300-14.
‖ Bryologist, ix. (1906) pp. 62-6. ¶ Tom. cit., p. 72.
** Brooklyn, New York, pp. 167-246 (20 pls. and 55 figs.).

simplified account of the moss-families comprised between Tortulaceæ and Leskeaceæ.

Hepatics of Middle Europe.* — K. Müller continues his general treatment of the hepatics in Rabenhorst's "Kryptogamenflora von Deutschland," finishing the account of the reproductive organs, and passing on to the sporophyte, which he discusses under the heads: development of the embryo; stalk; capsule; spores and their development; elaters. Vegetative reproduction includes sections in which gemmæ, adventive shoots, and tubers are treated. The biology of the hepatics comprises questions of symbiosis and adaptability to dry or wet environment. Finally, hints to the collector are supplied.

Mosses of Baden.† — T. Herzog brings to an end his bryogeographical sketch of the moss-flora of Baden. He discusses the characters of the moss-floras of the Franconian Jura, the Bodensee region, the Rhine-plain, the Kaiserstuhl, the Odenwald, and concludes with a long table exhibiting the horizontal distribution of the species in Baden, which for the purpose is here divided into eleven districts.

Mosses of Zurich.‡ — P. Culmann publishes a supplement to the catalogue of mosses issued a few years ago by himself and J. Weber. It consists of a list of hepatics of the canton of Zurich, including parts of the valleys of the Rhine, the Töss, the Glatt, the Limmat, the Sihl, and the Reuss. Ninety-seven species are recorded.

Moss-flora of Tyrol.§—A. Holler published as the last paper before his death, a list of the mosses from Tyrol and the neighbouring Bavarian Alps, represented in his large herbarium. Records from Eastern Allgäu are also included. The list includes important finds made by Sendtner, Molendo, Progel, Berggren, Sauter, Bamberger, Arnold, and others. The height above sea-level is always indicated. *Hypnum pygmæum* Molendo is the true *H. condensatum* Schimper according to the original plant of Sendtner in Herb. Schimper; forms of *H. revolutum* and of *H. Vaucheri* were distributed by Molendo under that name. *H. condensatum* Schimp. belongs to *H. revolutum* Mitten, not to *H. Bambergeri* Schimp.

New Austrian Mosses.‖—V. Schiffner and J. Baumgartner describe two new mosses from the Wachau, or valley of the Danube, in Lower Austria, to wit, *Cinclidotus danubicus* and *Didymodon austriacus*. The latter is most closely related to *D. cordatus* and *D. rigidulus*. *Cinclidotus danubicus* is an aquatic species closely related to *C. riparius*, with which it often grows intermixed. The authors compare the characters of the two species in parallel columns. Both the new species are widely distributed in the district, and, according to the authors, are distinct and good species.

* Leipzig: Kummer, 1906, vi. lief 2, pp. 65–128.
† Bull. Herb. Boissier, vi. (1906) pp. 551–70, 621–48.
‡ Tom. cit., pp. 571–81.
§ Ber. Nat.-Med. Ver. Innsbruck, xxix. (1906) pp. 71–108. See also Hedwigia, xlv. (1906) Beibl., p. 135.
‖ Oesterr. Bot. Zeit., lvi. (1906) pp. 154–8.

Hepaticæ of Dalmatia.*—V. Schiffner publishes a complete list of all the species of Hepaticæ hitherto known from Dalmatia. The total number of species is thirty-eight, among which are two species new to science, *Riccia Levieri* and *Cephalozia Baumgartneri*, which are both described at some length. The former is most closely allied to *Riccia macrocarpa*, from which it is distinguished by the presence of marginal cilia, by a difference in the spores, etc. *Cephalozia Baumgartneri* is a calcareous species, and most nearly allied to *C. Bryhnii* Schiffner, but is a coarser plant, and differs in many details as well as in the manner of growth and in habit. In appearance *C. Baumgartneri* resembles *C. stellulifera*, but differs also from that species in several points. The small number of species recorded from Dalmatia is partly the result of the small area of woodland and damp ground in that country, and partly arises from the absence of collectors. The author records eighteen species new to Dalmatia.

Bohemian Mosses.†—F. Matouschek publishes the first part of his revision of the moss herbarium in the Landes Museum at Prague. All the plants, even the oldest, are recorded. The synonymy in this paper is of great value, for the collection includes authentic species and varieties of P. M. Opiz. Many critical species are here re-described, and of others the distribution in Bohemia is given more accurately. Many species must be removed from the list of Bohemian plants. A new variety, *Rhacomitrium heterostichum* Hedw. var. *epilosum* Mat. is described. Hepaticæ are added at the end of the paper. The second part of the work will appear in 1907.

Hungarian Mosses.‡—I. Györffy, continuing his moss-flora of the Hohe Tatra, publishes some additions to our knowledge of *Plagiobryum Zierii* and *P. demissum*. He shows how the water-conducting tissue is not confined to the costa, but includes other parts of the leaf; the deuter-cells in the costa are sometimes three instead of two; the chloroplasts in the leaf-cells are few, the leaves and stems being too crowded to permit of free assimilation; on the other hand, the neck of the capsule is long, well provided with stomata, and eminently fitted for its assimilative work; the stomata are sunk in depressions, though hitherto described as on a level with the neighbouring cells, which is commonly the case among mosses. The distribution of the species is rare in Hungary, except in the Hohe Tatra. As to the other species, *P. demissum*, the leaves are ovate-lanceolate and long-pointed; the curvature of the thick yellow seta and asymmetric capsule bend the tiny operculum down till it is hidden in the tuft, and the neck of the capsule is uppermost and exposed to the light, and acts as an assimilative organ. The stomata lie on a level with the surrounding cells, and are abundant on the neck. The spores persist in tetrads. The author has found the species in Hungary, but only in the Hohe Tatra, and says it is probably overlooked because of its small size.

I. Györffy § publishes notes upon the following new or rare Hungarian

* Verh. k.k. Zool. Bot. Gesell. Wien, lvi. (1906) pp. 263–80 (1 pl.).
† Mitt. Ver. Natur. Reichenberg, xxxvii. (1906) pp. 1–22. See also Hedwigia, xlv. (1906) Beibl., p. 135.
‡ Magyar Bot. Lapok, v. (1906) pp. 210–18 (2 pls.).
§ Tom. cit., pp. 228–31.

mosses: — *Polytrichum piliferum* var. *Hoppei* Rabenh.; *Catharinea Hausknechtii* Broth., with fruit; *Neckera Besseri* var. *rotundifolia* Mol.; *Anomodon attenuatus* f. *integer*, new form with fruit; *Fissidens decipiens* De Not.; *Hylocomium splendens* Br. et Sch., with fruit.

Hepatics of Naples.*—E. Migliorato has compiled a bibliography of the hepatic flora of the Abruzzi and Naples districts, giving the results in three lists: 1. Alphabetical list of authors, with their works. 2. Chronological table of the authors. 3. List of the localities, with the names of the authors who studied their hepatic flora. Migliorato has prepared a manuscript alphabetical catalogue of the species contained in these works, and puts it at the disposition of hepaticologists interested in the districts.

Bryology of Sorrento.†—G. Negri gives an account of the mosses of this district, founded on collections made by himself in December and April of 1903 and 1904. He delimits the peninsula topographically, and points out that it includes three groups of mountains, the height and extent of which he describes. The geological formations and the climate are also considered, and the effect of these on the moss-flora. Certain species are enumerated which are found in the highest zones of the mountain regions, and also occur lower down; and a list is also given of the Mediterranean species of the district. After deducting these two short lists and the cosmopolitan species from the total number of species recorded, it is found that the sub-mountainous region provides a good third of the remainder. As regards the influence of the calcareous stratum on the moss-flora, it is found that of 116 species and varieties 21 are exclusively calcareous, 26 prefer it, 29 are indifferent, 19 tolerate it, and 20 are calcifugous. In the general enumeration of the species the attitude of each as regards this point is stated. A new variety, *augustifolium*, is described for *Mnium albicans* Simp.

Sicilian Bryophytes.‡—G. Zodda begins a series of contributions to the bryology of Sicily and the adjacent islands. The bryophytes of Messina are excluded, as they have been already treated of in another series of papers by the author, the first of which appeared last year. The material on which the present short list is founded was collected at Riesi, a town in the province of Caltanissetta, in Southern Sicily; at Linosa in 1884, by Dr. Solla; and at the same place, in April of last year—on a volcanic rock entirely covered by lichens—by the author himself. The two former collections were found by Dr. Zodda in the herbarium of the Royal Botanic Institute at Messina, and all the species, numbering 15, given in the present paper constitute the first records for their respective localities. Three hepatics were also found in Dr. Solla's collection. They were recorded as growing intermixed with *Tortula æstiva* on volcanic tufa of Monte Bandiera.

Brazilian Hepatics.§—P. Dusén, in his account of the flora of the Serra do Itatiaya in Brazil, gives two lists of hepatics—one consisting of

* Annali di Botanica, iv. (1906) pp. 294–300.
† Atti Rend. Accad. Sci. Torino, xli. (1906) pp. 559–74.
‡ Malpighia, xx. (1906) pp. 90–4.
§ Arch. Mus. Nacion. Rio de Janeiro, xiii. (1903) pp. 109–19.

42 species, five of which are new, from the upper parts of the mountain; the other consisting of 19 species, one of which is new, from the lower slopes. They were collected by him during his expedition, undertaken on behalf of the National Museum at Rio de Janeiro, in May to July 1902; the specimens were determined by Stephani.

Bryophytes of Norfolk Island.*—J. H. Maiden, in his account of the Flora of Norfolk Island, publishes a list of eight mosses and ten hepatics that have been recorded as occurring in the island.

Japanese Muscineæ.†—F. Stephani publishes lists of hepatics from the provinces of Kai and Tosa, amounting in all to 76 species. F. Stephani and V. F. Brotherus‡ give lists of 17 hepatics and 41 mosses respectively, all collected on Mount Kōya. G. Kōno§ gives an account of two new mosses, *Grimmia Konoi* and *Brachythecium Konoi*, both named by Brotherus. The text is in Japanese. J. Matsumura‖ publishes an index of Japanese plants with the species arranged alphabetically under their classes. The habitat, Japanese name, citations of literature, synonyms, and a bibliography are added. The hepatics number 240 species, and the mosses 725.

New Species of Sphagnum.¶—C. Warnstorf describes seven new species and a new variety of *Sphagnum*, all collected by Mosén in Brazil, and preserved in the Stockholm Botanical Museum. Their main characters are figured in the text, and the species belong to the groups *acutifolium*, *subsecundum*, and *cymbifolium*.

European Species of Philonotis.**—L. Loeske publishes a critical revision of the European species of *Philonotis*. In a paper in the same journal a few months previously, he showed by a few examples how inadequately some forms of this difficult genus have been treated in the past. Since then he has examined numerous specimens sent to him by leading bryologists who have pressed for his opinion. He has accordingly put together his principal results in the present paper, his projected monograph being postponed for the present. He recognises twelve European species as valid:—*P. rigida* Brid., *P. marchica* Brid., *P. media* Bryhn, *P. Arnellii* Husnot, *P. Ryani* Philib., *P. caespitosa* Wils., *P. Osterwaldii* Warnst., *P. tomentella* Molend. (including *P. borealis* Limpr. and *P. anceps* Bryhn), *P. fontana* Brid., *P. seriata* Lindb., *P. calcarea* Schimp., *P. Schliephackei* Roell. Each of these is critically discussed, and its synonymy is appended.

Riccardia major.††—V. Schiffner publishes some observations on *Riccardia major* S. O. Lindb., being a vindication of his views on the great value of characters founded on the structure of the sporogonial wall, characters upon which the late Abbé Boulay had cast some doubt.

* Proc. Linn. Soc. New South Wales, xxviii. (1903–4) pp. 740–1.
† Tokyo Bot. Mag., xx. (1906) pp. 52–4.
‡ Tom. cit., pp. 64–65. § Tom. cit., pp. 79–82.
‖ Index Plantarum Japonicarum. Tokio: Maruzen, 1904, i. pp. 222–83, 368–82.
¶ Beih. Bot. Centralbl., xx. (1906) pp. 128–39 (figs.).
** Hedwigia, xlv. (1906) pp. 195–212.
†† Oesterr. Bot. Zeit., lvi. (1906) pp. 169–74.

Schiffner had demonstrated the presence of certain semicircular thickenings on the inner tangential walls of the innermost cell-layer of the sporogonial wall in *R. major*, and their entire absence in *R. sinuata*. Boulay attributed the absence of these thickenings in the material of *R. sinuata* examined by Schiffner to the damp nature of its habitat. But Schiffner points out that *R. sinuata* is always a semi-submerged plant, and maintains that the sporogonial structure of any species of hepatic is, in his wide experience, never altered in any essential point by a mere change of habitat. And having carefully repeated all the work, he finds that his results were absolutely correct. After indicating further distinctions between the two species, he gives the geographical distribution of *R. major* as represented in his own herbarium, a distribution now extended from Scandinavia to France, Bulgaria, and California.

Lophocolea.*—F. Stephani continues his systematic exposition of descriptions of hepatics of the whole world, being now chiefly concerned with the genus *Lophocolea*, and in particular with those species which occur in the Southern Hemisphere. These amount to 60; and 10 of them are described as new; but all of the 60 are redescribed on a uniform plan.

Mounting Mosses.†—J. F. Collins gives some hints about mounting mosses for the herbarium. He has abandoned the method of attaching the envelopes or pockets containing the specimen to the sheet with pins, and uses instead gummed wafers—half inch disks of paper gummed on both sides. These are obtainable of all stationers in the United States, and are cheaper even than pins. A single wafer is enough to hold most envelopes firmly; and the gum sticks at once. If necessary the envelope can be easily detached at any time by one sweep of a paper-knife, the wafer splitting readily. If the specimens are to be mounted exposed on the sheet, the method of procedure is as follows: commercial liquid glue, diluted with about an equal quantity of vinegar or water, is brushed in a thin layer over a sheet of glass; upon this the specimen is rapidly pressed and transferred to its position on the herbarium sheet. Finally, those specimens which, being small, have been mounted with a lump of the soil they grew on, and which give trouble through the crumbling away of the soil, are easily hardened by the application of a few drops of diluted white shellac—1 part of shellac to 3 parts of 95 per cent. alcohol.

Monœcism of Funaria.‡—L. A. Boodle, finding the inflorescence of this species to be described as monœcious in bryological works, and as diœcious in botanical text-books, has closely examined the case. His results are that the plants are as a rule monœcious. The main axis is terminated by a male flower. The female stem is a branch of the male, is situated upon it anywhere from high up to low down, and usually has a tuberous rooting base, which, when detached, gives it the appearance of an independent plant. The female branch may be borne on a male

* Bull. Herb. Boissier, vi. (1906) pp. 535–50, 649–64.
† Bryologist, ix. (1906) pp. 60–2.
‡ Ann. of Bot., xx. (1906) pp. 293–9 (figs.).

axis which is itself a branch of a male stem. If diœcism occurs at all in the species it is very rare.

Multiple Chromatophores in Anthoceros.* — D. H. Campbell collected in Java an *Anthoceros* which showed frequent instances of double chromatophores in the superficial cells and multiple chromatophores in all the inner cells. The plant has spiral elaters, and no stomata in the sporophyte, thus approaching more to *Dendroceros*; but the thallus is that of a typical *Anthoceros*. The solitary antheridium and the presence of chlorophyll in the ripe spores recall *Dendroceros*. Perhaps an intermediate genus will have to be founded.

Spores of Riccia glauca.†—R. Beer has studied the development of the spores of *Riccia glauca* in the light of modern methods, and adds to the facts established by the researches of Leitgeb, Strasburger, Garber, and Lewis, upon other species of the genus. He describes the delicate primary membrane that separates off the spore-mother-cells from one another, and its secondary thickening layers, the mucilaginous degeneration which the latter partly undergo when the spore-mother-cells round themselves off and separate; the absence of food material between the separated mother-cells; the structure of the resting nucleus of the mother-cell, its nucleolus, chromosomes, and division phenomena; the primary membrane of the daughter-cells and its subsequent thickening, its cuticularisation and lamination; the callose plugs of mucilage at the equatorial rim; the nature of the endospore; the active part played by the protoplast in forming its membranes; the source of the material used for wall-formation; the doubtful origin of the mucilage among the spore-tetrads.

Gemmæ of Amblystegium.‡—C. Warnstorf describes the vegetative reproduction of *Amblystegium densum* Milde, the history and relationships of which he briefly sketches. Juratzka called attention to the pro-embryo threads on the leaf-points, and rhizoids on the back of the costa. Limpricht regarded the produced leaf-apex as being only a rhizoid. Warnstorf now points out that the threads on the back of the costa are true rhizoids having oblique transverse walls, while those arising from the leaf-apex are true protonema with transverse walls placed at right angles. The rhizoids are much branched, pale, yellowish, and warty; they occur in clusters on creeping stems of a fragile nature. The real reproductive organs, the true protonema threads are simple, filamentous, yellow, smooth, subclavate, about 16 μ thick, and arise from initial-cells on the back of the leaf point, and are easily detached.

Monstrous Peristomes.§—I. Hagen writes an historical note on "acrosyncarpie renversée" in mosses. In the previous number of "Hedwigia," Mönkemeyer had described and figured for *Dicranella varia* and *Bryum saxonicum* some instances of abnormal supplementary peristomes intercalated between the operculum and the normal peristome, in the belief that such an occurrence had not been recorded

* Ann. of Bot., xx. (1906) p. 322. † Tom. cit., pp. 275–91 (2 pls.)
‡ Allg. Bot. Zeitschr., xii. (1906) pp. 106–8.
§ Hedwigia, xlv. (1906) pp. 239–40.

before. Hagen admits the novelty of the instance in which two extra peristomes are intercalated upside down between the normal peristome and the operculum, but points out that simpler cases of this abnormality have been described for other species—e.g. *Camptothecium lutescens*, *Homalothecium sericeum*, and *Mnium medium*—by Gümbel, Schimper, and Lindberg.

Thallophyta.

Algæ.

(By Mrs. E. S. Gepp.)

North American Algæ.*—F. S. Collins publishes diagnoses of the new species, etc., issued in the "Phycotheca Boreali-Americana," the first fascicle of which was issued by Collins, Holden and Setchell in February 1895. The author has distributed in that work a number of new species, varieties and forms, and in some cases the diagnosis was printed in the label, while in others a reference was given to the publication elsewhere. To prevent possible future complications, the descriptions in question are reprinted in the present paper, and if the rule for higher plants should be made to hold good for Cryptogams, this article would be the original reference. Eight new species are described, one new combination, and 26 varieties and forms.

Marine Flora of Jan Mayen.†—F. R. Kjellman gives an account of the marine algæ of this island, founded on previous collections and on some plants brought home by Dr. Gran in 1900, and determined by the present author. This collection consists of 26 species, of which seven are new to science, though the author thinks some of them may have been included in other lists under another name. Critical notes are made on most of the species recorded, and following on the systematic treatment is a consideration of the marine flora of the island from various points of view. The author holds that Jan Mayen must be regarded as a separate province in the Arctic region of geographical distribution, having a certain relationship to Spitzbergen and Greenland. As regards the ecological conditions, nothing is known, but the flora appears to be entirely from deep water. Nothing is recorded of a littoral vegetation. Hauck mentions the occurrence of *Fucus evanescens* at a depth of 20–30 metres, and the same depth is given for *Ascophyllum nodosum*. The depth at which vegetation begins is said to be 5 metres. Very little is known about the formations, though, from remarks made by Hauck, it may be inferred that species of *Laminaria* and of *Fucus* and *Ascophyllum nodosum* are common. The author believes that the apparent poverty of the flora of Jan Mayen is due merely to the slight knowledge we have of it. Algæ appear to be drifted to the island by currents from the east.

Marine Algæ of the Mediterranean.‡—F. Ardissone completes his review of the algæ of the Mediterranean, the first part of which was published in 1901, and contained an account of the Rhodophyceæ. The

* Rhodora, viii. (1906) pp. 104–113.
† Arkiv f. Botanik, v. (1906) No. 14, pp. 1–30 (3 pls.).
‡ Rend. R. Ist. Lombardo Sci. Lett., xxxix. (1906) pp. 156–76.

present part contains the treatment of the Phæophyceæ, Chlorophyceæ, and Cyanophyceæ. Interesting observations are made on *Haplospora Vidovichii* Born., *Ectocarpus confervoides* Le Jol., *Giffordia Lebelii* Batt., and *Myrionema punctiforme* Harv.

V. Spinelli * has made a study of the marine algæ of Sicily, from which island he records 160 species. Special observations are made on the following: *Schizymenia Dubyi* J. Ag., *Halymenia ligulata* J. Ag., *Callymenia demissa* J. Ag., *Nitophyllum uncinatum* J. Ag., and *Codium elongatum* Ag.

Marine Algæ from New South Wales.†—A. and E. S. Gepp publish notes on a small collection of marine algæ made by Mr. A. H. S. Lucas mainly in the neighbourhood of Sydney. The novelties described are: *Dictyota prolificans*, *Gracilaria Lucasii*, new varieties of *Rhabdonia robusta* and *Grateloupia filicina*, and a new form of *Pterocladia lucida*. The cystocarps of *Kallymenia tasmanica* and *Grateloupia australis* have been found for the first time in this collection, and the latter species is also here described, having been till now merely a *nomen nudum*. The characters of the fertile frond of *Dictyota nigricans* are figured to show the difference between this species and *D. prolificans*; no figure of the former species had hitherto been published. *Gracilaria Textorii* is here recorded from New South Wales, being the only locality in which it has been found outside Japan. Mr. Lucas's notes on each species are added to the critical notes of the authors.

Norfolk Island Algæ.‡—A. H. S. Lucas gives a list of ten marine algæ in J. H. Maiden's account of the flora of Norfolk Island. They were collected by Robinson, Maiden, and Boorman in November 1902. No algæ, save *Plocamium hamatum*, appear to have been previously recorded for the island.

Japanese Algæ.§—J. Matsumura publishes an index of Japanese plants, with the species arranged alphabetically under their classes and sub-classes. The habitat, Japanese name, citations of literature, synonyms, and a bibliography are added. The algæ attain a total of 1357 species, including 21 Schizophyceæ, 557 Diatomaceæ, 134 Conjugatæ, 115 Chlorophyceæ, 17 Characeæ, 174 Phæophyceæ, and 339 Rhodophyceæ.

Yorkshire Fresh-water Algæ.‖—W. Ingham gives a list of twenty-one of the more interesting fresh-water algæ recorded for the York district. Most of these come from Pilmoor, where so many as 130 species of Desmids have been found.

Fresh-water Algæ from Finland.¶—A. J. Silfvenius publishes some notes on the distribution of Chlorophyceæ and Cyanophyceæ in Finland. He enumerates 111 species, of which 92 are Chlorophyceæ

* Atti Accad. Sci. Nat. Catania, xviii. (1905) 55 pp.
† Journ. of Bot., xliv. (1906) pp. 249–61 (1 pl.).
‡ Proc. Linn. Soc. New South Wales, xxviii. (1903–4) pp. 745–6.
§ Index Plantarum Japonicarum. Tokio: Maruzen, 1904, i. pp. 3–127, 364–5.
‖ Handbook to York, Brit. Assoc., 1906, pp. 294–5.
¶ Meddel. Soc. Fauna Flora Fennica, xxix. (1904) pp. 10–22.

and 19 Cyanophyceæ. Seven species are new records for Finland. A new form, f. *major* of *Spirogyra longata* Kuetz. is described and figured.

New England Desmids.*—J. A. Cushman gives a list of the species of Desmids belonging to the sub-family Saccodermæ, found in New England. Twenty-seven species and varieties are recorded, of which one species, *Mesotænium minimum*, and three varieties of other species, are new. This list doubles the number previously known from that region, but the author anticipates a further increase of records, when the White Mountain region shall have been carefully worked. At the end of the paper a key is given to the New England genera and species, which, though based upon the species from that district actually seen by the author, will, nevertheless, largely apply to the North-eastern United States.

Morphology and Biology of Chara delicatula f. bulbillifera A. Braun.†—O. Kuczewski publishes a dissertation on this subject under the following headings: 1. Structure and development of the shoots and leaves of *Chara delicatula* Ag. and *C. fragilis* Desvaux. 2. Investigations into the vegetative reproduction of *C. delicatula* f. *bulbillifera*. The first part of his paper is divided into (1) external morphology; (2) development of the main stem; (3) lateral organs of the main stem, in which the author deals with the leaves, cortication, and stipules, axillary and accessory shoots. The second part of the paper consists of a treatment of the bulbils of the stem and root, the development of which is described and figured. Finally, the biological signification of these bulbils is considered, and experiments in connection with their growth are described.

North American Chareæ.‡—C. B. Robinson gives an account of the Chareæ of North America. He begins by describing the group as a whole, their habit, method of reproduction, development from the germinating oospore, the cortex of stem and leaves, etc. The author points out that the great majority of plants, when thoroughly understood, fall with perfect distinctness into a few well-marked groups, although within these groups the differences may be very considerable and of the most varied nature. The grouping defies all laws of geographical distribution. The forms of many species are so well marked and constant that some authors have been disposed to enlarge the number of species. The aim in the present work has been to take a middle course, as a wide view of species seems also untenable. A short history of past work on Characeæ is given, and the author points out the two views as to their affinity which have been followed respectively by Engler and Prantl, and Strasburger: the former regard them as the highest order of Chlorophyceæ, related to *Coleochæte*, while the latter make them into a separate sub-kingdom. A synopsis of the genera of Characeæ is followed by a key to the 50 North American species of *Chara*, the only genus represented in that country. Each species is described in full, and 15 are new. References are given to existing illustrations, and

* Bull. Torrey Bot. Club, xxxiii. (1906) pp. 343–51.
† Beih. Bot. Centralbl., xx. (1906) pp. 25–75 (2 pls., figs. in text).
‡ Bull. New York Bot. Garden, iv. (1906) pp. 204–308.

exsiccatæ, and the distribution of each species throughout the world is noted. A bibliography of Characeæ and an index conclude the work.

Characeæ from the Cape Peninsula.*—H. and J. Groves describe a small collection of eight numbers, representing seven species, made by Major Wolley-Dod on Table Mountain and the adjacent hills. Among them are two of our common European species, *Chara vulgaris* and *C. fragilis*, the rest being apparently endemic to Africa, and one being a new species, *C. Tanyglochis*. The plants were very scarce. Since the earlier half of the last century little has been done in collecting Characeæ in Cape Colony and Natal. The most interesting feature of the *Chara* flora of Cape Colony is the presence of species intermediate between the two sections Diplostichæ and Triplostichæ, which in other parts of the world are fairly distinct.

Polysiphonia violacea.†—S. Yamanouchi gives a brief preliminary sketch of his cytological studies on *Polysiphonia violacea* Grev., dividing his notes into methods, germination of the carpospore and tetraspore, spermatogenesis, oogenesis and fertilisation, tetraspore formation, and abnormalities. He finds that the germinating carpospore contains forty chromosomes, and the tetrasporic plant the same number; from which he infers that the tetrasporic plants come from carpospores. The germinating tetraspore contains twenty chromosomes, and the sexual plants the same number, from which he infers that the sexual plants come from tetraspores. The nuclei of the gametes contain each twenty chromosomes. The fusion nucleus has forty chromosomes, and gives rise to a series of nuclei, some of which enter the carpospores. Tetraspore formation terminates the sporophytic phase with typical reduction phenomena, so that the tetraspores are prepared to develop the gametophytic generation. There is thus an alteration of sexual plants (gametophytes) with tetrasporic plants (sporophytes) in the life-history of *Polysiphonia*, and the cystocarp forms a part of the sporophytic phase.

Spermatozoids of Fucaceæ.‡—G. Retzius, who has been occupied for some time on a study of the spermatozoids of the Evertebrata, has now turned his attention to those of the Fucaceæ. He finds that, on the whole, the spermatozoids of the lower animals and of Fucaceæ show a remarkable similarity, but he is unable to say whether this extends also to other groups of algæ. He finds in both the Fucaceæ and in many of the worms, molluscs, etc., a rosette of 4–5 spherules, which constitute the body described by Guignard and others as the nucleus. It does not lie within the body of the spermatozoid, but is outside it, and belongs to the protoplasmic mantle. In front of the rosette of spherules is the eye-spot, or chromatophore, which also lies outside the pear-shaped body of the spermatozoid. The author then describes the two cilia, of which the posterior one is always longer than, sometimes twice as long as, the anterior one. The cilia are stout enough to be examined in detail, and the author finds that both suddenly taper to a fine point at their free end. This is also found among the lower

* Journ. Linn. Soc. Bot., xxxvii. (1906) pp. 285–7 (1 pl.).
† Bot. Gazette, xli. (1906) pp. 425–33.
‡ Arkiv f. Botanik, v. (1906) No. 10, pp. 1–9 (figs. in text).

animals. The author is inclined to think that the cilia are connected at their point of attachment, but he has not been able to decide this question definitely.

Colouring Matter of Phæophyceæ.* — M. Tswett continues his researches on this subject, and in the present paper treats of the so-called phycophæin and of the true colouring matter of the chromatophores of Phæophyceæ. He finds that living Phæophyceæ contain no pigment soluble in water—i.e. "phycophæin." Their chromatophores are tinged with chlorophyllin a and γ, fucoxanthin, carotin, and fucoxanthophyll, the combination of which forms the natural brown-green colour of these algæ. The green discoloration often met with arises from the dissolution or destruction of the fucoxanthin, which is reddish-brown in a fixed condition, but yellow in solution.

Actinococcus.† — F. Heydrich has succeeded in finding the sexual organs of *Actinococcus peltæformis* Schmitz, and gives an account of them in the present paper. The material was collected in Marseilles, and contained three male and two female plants. Tetrasporangia, antheridia, and procarpia are described in detail and figured. The carpogonia are seated inside the thallus cushion at varying depths, and are apparently somewhat difficult to recognise. According to the author the peculiar structure of the fruit entitles *Actinococcus* to a systematic position in a group of its own, Actinococcales, between Nemalionales and Gigartinales. The distinguishing character of the group is that the carpogonium takes no part in the formation of spores, and although an auxiliary cell is present, the two extra intermediate cells are wanting. A resemblance is pointed out between the procarpia of *Actinococcus* and *Eleutherospora*, inasmuch as in both genera the hypogynous cell bears the carpogonium with the trichogyne, and in both that same cell becomes the auxiliary cell, and bears the spores directly. The author holds that single cushions are the result of spore germination, while those which form a group are propagated by rhizoids creeping in the host-plant.

Fibres in Cladophora.‡ — F. Brand has established without doubt the presence of fibres and fibrils in the membrane of three species of *Cladophora*, *C. hospita* Kütz, *C. intertexta* Collins and *C. Montagnei* Kütz. var. *waianeana*. Till now, the existence of fibres in the cell-membrane of *Cladophora* has been a disputed point, but the present paper settles the question. The fibres and fibrils do not cross each other like the threads of linen, but pass near and over each other. For the present the author can give no complete treatment of the subject, but he will do so in a later work. Meanwhile, he gives a detailed account of his successful method of reviving dried *Cladophora* material. Roughly, it is as follows: soak for at least twenty-four hours in acidified distilled water, then treat with Schultze's macerating solution, slightly warming it the while, then for a few minutes with very strong chromic acid solution; wash, and stain with a weak solution of ruthenium red.

* Ber. Deutsch. Bot. Gesell., xxiv. (1906) pp. 235–44.
† Tom. cit., pp. 71–7 (1 pl.). ‡ Tom. cit., pp. 64–70 (1 pl.).

Some Endophytic Algæ.*—A. D. Cotton records some observations on the life-history of *Endoderma viride* Lagerheim, and deals also with two species of *Streblonema*, *S. intestinum*, and *S. Zanardinii*. The plants of *Endoderma* studied by the author were endophytic in *Nitophyllum Hilliæ*, and in case future authors should regard this *Endoderma* plant as distinct from the typical endophytic form in *Derbesia*, it is here named f. *Nitophylli*. The vegetative structure is described, as well as the formation of zoospores. The germinating spores are rarely seen on *N. Hilliæ*, and the plant spreads very readily by a purely vegetative method. No light is thrown on the difficult question of what becomes of the spores during the winter. The growth of *Endoderma viride* f. *Nitophylli* takes place entirely within the substance of the host-plant, and there is no trace whatever of external branches or hairs. It is not in any way parasitic. A list of species is given in which this endophyte has been found. The original description of *Streblonema intestinum* (*Entonema* Reinsch) being quite inadequate, a new description is here given, based entirely on Reinsch's preparations. The species differs from *S. parasiticum* Sauv., which occurs in *Cystoclonium* and *Ceramium* by the larger sporangia, and by the apparent absence of external filaments. A short note on *S. Zanardinii* De Toni adds to our somewhat scanty knowledge of the plant. The plurilocular sporangia are described, and a bifurcating example is figured.

On "Zoochlorella" in Convoluta.†—F. Keeble and F. W. Gamble give a preliminary account (1) of experiments proving that the green cells (zoochlorellæ) of *Convoluta roscoffensis* result from infection from without; (2) of the means whereby the infecting organism may be cultivated outside the body of the animal; and (3) of the nature of the infecting organism. A detailed account is given of the mature alga which, in the opinion of the authors, belongs to Chlorophyceæ, and is allied to *Chlamydomonas*. The presence of four equal flagella suggests that they belong to the genus *Carteria*.

Fossil Diatoms.‡—A. M. Edwards reports on 16 samples of infusorial earths containing diatoms sent to him by the United States Geological Survey. They are interesting as coming from the great plain of Fremont in Utah, Nevada and California, called by the author the Occidental Sea. Lists of species found in each of the samples are given. The author makes some remarks on the geology of the tract examined. He maintains that the lakes Bonneville and Lahontain were formed in the earlier Tertiary, possibly the Eocene or the Cretaceous, and that the "infusorial earth," which is clayey, was formed before the clay Oligocene of California from Monterey, Redondo Beach, etc. The infusorial clay of the Great Plain constitutes the bed of an extinct sea, the Occidental sea.

North Atlantic Plankton.§—C. H. Ostenfeld publishes a catalogue of the species of plants and animals observed in the plankton collected during periodical expeditions from August 1902 to May 1905, under-

* Journ. Linn. Soc. Bot., xxxvii. pp. 288–97 (1 pl.).
† Proc. Roy. Soc., Series B, lxxvii. (1905) No. B 514, pp. 66–8.
‡ Nuov. Notar., xvii. (1906) pp. 102–7.
§ Copenhagen: Hoest et fils, 1906, 122 pp.

taken by the International Commission for the exploration of the sea. The region explored includes the Arctic, North Atlantic, Norwegian Sea, North Sea, the Channel, Skager-Rak, Cattegat, the Sound, Danish Sea, Baltic, Finland Gulf, and Gulf of Bothnia.

Phytoplankton of Temperate Seas.*—B. Schröder gives a preliminary account of the characteristics of the phytoplankton of temperate waters, being the result of investigations by himself and others. He regards it as pre-eminently "polymiktes" plankton, for it consists almost entirely of many species which are represented by but few individuals; it rarely occurs that one species is largely predominant or forms great masses. As an instance of this variety of species in temperate waters, the author points out that while his material from the Indian Ocean showed 118 species, that from Japanese waters contained 147. Special cases are quoted in which certain species were found to predominate: *Chætoceras Schüttii* Cleve in the Bay of Naples in autumn, a certain diatom which formed slimy masses at Triest, *Chætoceras* in the same locality, *Ceratium volans* Cleve in the Indian Ocean, etc. Lists are given of the principal species characteristic of (*a*) the warm Atlantic and Mediterranean; (*b*) the Indo-Malay Sea; (*c*) West Pacific (South and East China Sea and Japanese waters). It is noted that cold water species vary their form in temperate waters, and examples of this change are given.

Baltic Benthos and Plankton.†—H. Fraude divides his subject into two parts, a general and a special part. In the first he treats of the region studied, with its physico-chemical and biological properties, the phytoplankton of the Baltic, and the researches already made there. In the special part he deals with the first Holsatian expedition in 1887, with others by Cleve and Aurivillius in 1896, by Schütt in 1895, by Appstein in 1889, the second Holsatian expedition in 1901, and with his own personal collections. In the 36 plates the algæ are figured in systematic order.

Plankton of Lake Wörth in Carinthia.‡—K. v. Keissler continues his reports on the plankton of Carinthian lakes, and in the present paper enumerates the species found between March and September 1905 in Lake Wörth. To each species is appended a note on its seasonal distribution, and the list is also summarised in tabular form. *Ceratium* plays but a small part in the composition of the plankton, while *Lyngbya limnetica* Lemm. is well represented in August and September. *Clathrocystis* is also not uncommon in this lake, though rare in other Austrian Alpine lakes; it is common in North Germany. *Raphidium* and *Richteriella* are also recorded. The species of Lake Wörth are compared with those of Lake Ossiach and the Millstätter lake, showing that the differences are not inconsiderable.

BIANCHI, F.—**Ricerche su un laghetto alpino (Il Lago Deglio).** (Researches on a small Alpine lake, Lago Deglio.)
Rivista Geograf. ital. xiii. (1906) p. 15 (figs.).

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* Ber. Deutsch. Bot. Gesell., xxiv. (1906) pp. 260–3.
† Jahresb. Geogr. Gesell. Greifswald, x. (1906) 125 pp., 36 pls., 1 map.
‡ Oesterr. Bot. Zeit., lvi. (1906) pp. 195–202.

De Gasparis, A.—**Le Alghe delle argille marnose pleistoceniche di Taranto.** (The algæ of the Pleistocene marly clay of Taranto.) *Att. Accad. Sci. Napoli*, xii. (1905) 8 pp. (1 pl.).

Gutwinski, R. & Z. Chimelewski.—**Contribution à l'étude des Algues du Kameroun.** (Contribution to a study of the algæ of Cameroon.) *Ann. biol. lacustre*, i. (1906) pp. 168–79.

Kjellman, F. R.—**Om främmande alger ilanddrifna vid Sveriges västkust.** (On foreign algæ washed ashore on the west coast of Sweden.) *Arkiv f. Botanik*, v. (1906) No. 15, pp. 1–10.

Kofoid, C. A.—**Dinoflagellata of the San Diego Region. 1. On Heterodinium, a new genus of the Peridinidæ.**
[The author proposes the name of *Heterodinium* for a new genus which is to include 13 species, of which five are new. It is divided into three sub-genera.] *Univ. California Publications, Zoology*, ii. (1906) pp. 341–68 (3 pls.).

Mazza, A.—**Saggio di Algologia oceanica.** (Essay on oceanic algology.)
[A continuation, which includes *Acrotylus*, *Endocladia*, *Chondrus*, *Iridæa*, and *Gigartina*.] *Nuov. Not.*, xvii. (1906) pp. 81–101.

Migula, W.—**Thomé's Flora von Deutschland. Kryptogamen.** (Flora of Germany. Cryptogams.)
[Continuation, finishing Diatomaceæ and beginning Desmideæ.] Gera: Zezschwitz, 1906, vi. lief. 30, pp. 353–84 (5 pls.).

Ross, H.—**Contribuzioni alla conoscenza della flora Sicula.** (Contributions to a knowledge of the Sicilian flora.)
[The author records seven species of Characeæ with varieties, adding critical notes thereon. The plants were collected in 1884–5 and 1887–97, and determined by L. Holtz.] *Bull. Soc. Bot. Ital.* (1905) pp. 254–8.

Fungi.

(By A. Lorrain Smith, F.L.S.)

Nuclear Fertilisation in the Mucorini.*—Dangeard holds that the cells which fuse to form the zygospore in the Mucorini are not to be regarded as gametes, but as gametangia. The protoplasm of the zygospore passes through a series of changes: from a dense condition it becomes vacuolar, then reticulate, and again vacuolar. At the close of the reticular period, the nuclei are seen to fuse in pairs; the mature zygospore contains a large number of the fused nuclei, which provide, on germination, the nuclei of the new hyphæ. Dangeard maintains that the nuclei which fuse come from the different gametangia. The fusions take place progressively as the different nuclei come into contact.

Contribution to the Study of the fleshy Discomycetes.†—J. Lagarde divides his paper into two parts; the first treats of the history, terminology, and technique of these fungi. The second and longer part includes the results of his own observation and research, and falls into three divisions—the general anatomy, the descriptions of different species and individuals; and finally, the conclusions he has drawn from the consideration of the group.

Lagarde follows Boudier in regarding the dehiscence of the ascus as an important factor in classification, and he recognises two great groups: those in which the ascus opens by a lid or cap, and those in which the

* Comptes Rendus, cxlii. (1906) pp. 645–6. See also Bot. Centralbl., ci. (1906) p. 647.
† Ann. Sci. Nat., ix. (1906) pp. 125–256 (2 pls. and 58 figs.).

spores escape by a pore. The first group includes the Morchellaceæ, Helvellaceæ, Pezizaceæ, and Ascobolaceæ. Those of the second group, in which the ascus opens by a pore, are the Geoglossaceæ, the Helotiaceæ, and the Mollisiaceæ. He finds that these two great groups form two series connected with each other by transitional forms. The Morchellaceæ and Helvellaceæ are distinguished from each other by the position of the hymenium, the contents of the spores, the form and dimensions of the paraphyses, and by the structure of the trama. The anatomical structure of the different forms bears out Boudier's original classification.

Pyrenomycetes of Germany, Austria, and Switzerland.*—Under this heading H. Rehm proposes to supplement the work done for these fungi by Winter, and to examine the mass of material accumulated since his day. He gives diagnoses where these are necessary, but, as a rule, he only cites the literature and adds the habitat, with explanatory notes in some cases.

New Genus of African Fungi.†—Hariot and Patouillard describe a remarkable fungus from East Africa, *Colletomanginia* g. n., which combines the characters of Helvellaceæ, Hypocreaceæ, and Sphæriaceæ. It forms a large, furrowed, hemispherical, hollow mass 17 cm. in diameter; the asci are inclosed in perithecia, which occur at the base of the furrows. The spores are simple, black, and appendiculate.

Origin of Yeasts.‡—Paul Vuillemin discusses the bearing of Viala and Pacottet's discovery on the yeast-plants. Formerly, true yeasts were regarded as those which, on cultivation, produced the so-called asci and endospores. The discovery that the yeast-forms of other fungi belonging to the Ascomycetes also form these endospores, leads them to be regarded as sporocysts, and though *Saccharomyces* as a genus must be preserved, its affinities must be looked for among the Fungi imperfecti.

Cysts of Glœosporium and their Role in the Origin of Yeasts.§ Viala and Pacottet continue their studies in this field of work. They have produced in a suitable medium the cysts of *Glæosporium ampelophagum*, and describe them as dark-coloured, smooth, somewhat brittle, and containing one or several brown spores 8–10 μ in length. The cysts of *G. nervisequum* are darker in colour and rough on the surface, with paler and more spherical spores, 8–14 μ in diameter.

In each species, cyst-formation is induced by desiccation, sudden lowering of temperature, etc. The spores produce on germination septate and variable filaments. In a sugar solution, these filaments break up and begin to bud out, forming yeasts.

Relation of Fungi imperfecti to Ascomycetes.‖ —H. Klebahn sums up the cases in which he has proved a connection between different fungi by infection experiments; *Gnomonia leptostyla* with *Marssonia*

* Ann. Mycol., iv. (1906) pp. 257–72.

† Comptes Rendus, cxlii. (1906) pp. 224–6. See also Bot. Centralbl., ci. (1906) p. 652.

‡ Rév. gén. Sci. pures et appliquées, xvii. (1906) pp. 214–29 (figs. 1–30). See also Bot. Centralbl., cii. (1906) p. 65.

§ Comptes Rendus, cxlii. (1906) pp. 518–20.

‖ Centralbl. Bakt., xv. (1905) p. 336.

Juglandis; *Gnomoniella tubiformis* with *Leptothyrium alneum*; *Mycosphærella sentina* with *Septoria nigerrima*; and *Pseudopeziza Ribis* sp. n. with *Glœosporium Ribis*. Details are promised in a future communication.

Some of his results are published * in a more recent paper on these fungi, his object being to establish the relationships between the different forms. He selected *Glœosporium Ribis*, which attacks the red currant, for examination, and obtained good infection results by sowing the spores on healthy leaves, and thus reproducing the *Glœosporium*. During the winter he sought for the ascus form on the decaying leaves. Among other forms of the fungus he found a Discomycete, which he places as a new species in the genus *Pseudopeziza*. He gives a detailed account of his various cultures and inoculations; he succeeded in reproducing the *Glœosporium* from the ascus spores of the *Pseudopeziza*. He draws attention to the fact that one cannot determine what may be the alternate form of any fungus without actual proof. In one case *Glœosporium* alternates with a Pyrenomycete; in this case the higher fungus is a Discomycete.

Notable Pycnidial Type.†—Tycho Vestergren describes a new species of Sphæropsideæ, *Diplodina Rostrupii*. He takes occasion to discuss the different types of this family, Sphæroidaceæ, Excipulaceæ, and Leptostromaceæ, distinguished from each other by the formation of the pycnidium. The species under discussion grew on the previous year's capsules of two forms of Ericaceæ, *Phyllodoce* and *Andromeda*, in the higher regions of Lapland. Vestergren describes the growth and appearance of mycelium, pycnidium, etc., the opening of the pycnidium, the hymenium, conidiophores, and conidia. Pycnidia and conidia vary in size to a great extent; the larger pycnidium containing the larger conidia, and different sized individuals occurring on the same capsule. The author warns systematists against making the size of conidia a specific character.

Botrytis cinerea.—Much damage is caused each year to grapes by this fungus, and J. M. Guillon ‡ reports the results of some inoculation experiments he instituted to find out the mode of attack by the *Botrytis*. He sowed spores on grapes that had been pricked, and in each case the rotting of the fruit followed. Results were not so quick nor so universal with undamaged grapes, but a very large percentage of these also were infected. The resistance offered by the pellicle to the penetration of the hyphæ was complete only in some cases.

Rhacodium cellare.§—F. Guéguen has published a morphological and biological study of this cave fungus. He traces its appearance in literature from the "*Byssus tenerrima, nigra, doliolaris*" of Ray (in 1690) down to Schröter's account of it in 1893. In wine growing countries it is considered to be harmful to the wines, as along with *Penicillium* and *Dematium*, it gives the objectionable cork odour. The various specimens examined differed slightly in colour and form, but

* Zeitschr. Pflanzenkr., xvi. (1906) pp. 65–83 (2 pls.).
† Arkiv Bot. v. (1906) No. 11, 14 pp. (2 pls.).
‡ Comptes Rendus, cxlii. (1906) pp. 1346–9.
§ Bull. Soc. Mycol. France, xxii. (1906) pp. 77–95, 146–63 (3 pls.).

the variations were not constant enough to be specific. The filaments are rigid, branched, and septate, and have a somewhat rougher membrane. By means of cultures he was able to follow the spore development—elongate, simple conidia borne in clusters at the tips of the fertile branches, and recalling the conidiophores of *Cladosporium* and *Dendryphium*. Spore production is rather rare.

Guéguen cultivated the fungus on a large number of nutritive media, the details of which are given, and he reproduced in them the differences in colour, structure, etc., that had been noted in the various specimens examined. He classifies *Rhacodium* in the group Dematieæ of the Hyphomycetes. Perithecia and pycnidia that have been found in conjunction with *Rhacodium cellare* belong to some other fungus.

New Genus of Hyphomycetes.*— Paul Vuillemin found this new fungus on a growth of *Aspergillus*; it formed a star-like structure, hyaline at the centre, brown towards the rays owing to the presence of brown spores. These are produced at the ends of the fertile filaments. He calls the new fungus *Hemispora stellata* g. et sp. n.

Uredineæ.—C. L. Shear† considers that he has good evidence from observation and from the results of open-air inoculation, for assuming a connection between *Peridermium cerebrum* on *Pinus virginiana* and *Cronartium quercuum*. He holds also that the Japanese fungus *Peridermium giganteum* is identical with *P. cerebrum*, the latter name having many years' precedence. Both forms of the fungus occur on several host species.

In his "Rust Notes for 1905," J. M. Bates‡ chronicles the finding of various Uredineæ in their several stages. He found an *Æcidium* on *Oenothera biennis*, and its uredo-form on a *Carex* close at hand, which have been proved to be new.

H. L. Bolley and F. J. Pritchard § publish an account of wheat rust. They give notes as to resistant varieties, and recommend attention to cleanness of seed, land free from weeds, with the destruction of wild grasses and barberry shrubs to keep the crops free from contamination.

Notes on Mycenastrum Corium.—As there has been much divergence of opinion as to the appearance of the mature spore in this fungus, L. Rolland ‖ has examined authentic specimens with great care. The spores are at first colourless and smooth, and borne at the end of short sterigmata. As they mature, they become an olive-purple colour, and are covered with small colourless warts. A small projection from the spore indicates the place of attachment to the sterigma. Rolland has also found the sterigmata of *Bovista* spores. He contrasts the tissues of the two genera.

Fungi in Cheese Ripening.¶—Chas. Thom has studied the physiological effects of such fungi as *Penicillium Camemberti*, *P. Roqueforti*,

* Bull. Soc. Mycol. France, xxii. (1906) pp. 125-9 (1 pl.).

† Journ. Mycol., xii. (1906) pp. 89-92. ‡ Tom. cit., pp. 45-7.

§ North Dakota Agric. Exper. Stat., Bull. No. 68, 1906 (30 figs.). See also Bot. Centralbl., cii. (1906) p. 38.

‖ Bull. Soc. Mycol. France, xxii. (1906) pp. 109-15 (1 pl.).

¶ U.S. Dep. Agric. Bur. Animal Ind., Bull. No 82, 1906 (3 figs.). See also Bot. Centralbl. cii. (1906) p. 40.

and *Oidium lactis* on Camembert and Roquefort cheese. The subjects treated are: the relation of moulds to acidity, the breaking down of the casein, liquefaction of gelatin, and flavours. He also examined the effects on the fungus, the growth of the mycelium and the relation of temperature and humidity to it, the question of contamination, and the vitality of the spores.

Mycological Observations.* — F. W. Neger sums up a series of notes on various fungi. He cites the evidence for and against the existence of the two species, *Sphærotheca mors-uvæ* and *Sph. tomentosa*. He believes them to be specifically distinct. He describes a new species, *Urophlyctis Magnusiana*, which was destroying plants of *Euphrasia*, causing swellings on the stalks and leaves. He affirms the immunity of certain, if not all, fir-trees against *Nectria cinnabarina*. Two occurrences of dry-rot in the open woods are recorded, and finally he describes the mechanism insuring the ejection of spores in *Sarcosphæria sepulta*, which is largely affected by the change from a moist to a dry atmosphere.

Destruction of Wood by Fungi.† — Basilius Malenković made a series of cultures with *Coniophora cerebella* to determine which were the elements in the wood destroyed by the fungus. He grew it on bread pulp as well as on wood, and came to the general conclusion that *C. cerebella* will destroy almost all substances that can be isolated from wood after they have been split up by lignolytic enzymes. He found that the results obtained were not exactly the same for all wood-destroying forms, but it was proved from them all that more wood was destroyed than was used in the nutrition of the fungus. Tables are given of the different cultures and the results ascertained.

Notes on Poisonous Fungi.‡—Mazimann, Plassard, and X. Gillot describe some maps of poisonous fungi that they have prepared, to warn people against using certain species for food. They have also published pictures of the edible forms. Gillot § gives further information about several poisonous species. He describes the circumstances in which these forms have been gathered and the bad effects that have followed on eating them. He cites as very dangerous *Amanita pantherina* which had been confounded with *A. rubescens* by some collectors. M. Barbier ‖ gives an account of poisoning following on the consumption of *Entoloma lividum*.

French Mycology.¶—Ant. Magnin describes various exhibitions of fungi that have been held at Besançon. The plants were arranged in different series, as edible fungi, poisonous fungi, rare or curious forms, etc. The writer comments on the success attending these exhibitions, and on the great interest shown in the subject by the non-botanical inhabitants.

* Ann. Mycol., iv. (1906) pp. 279–87.
† Centralbl. Bakt., xvi. (1906) pp. 405–16 (1 fig.).
‡ Bull. Soc. Mycol. France, xxii. (1906) pp. 164–5.
§ Tom. cit., pp. 166–9. ‖ Tom. cit. p. 170.
¶ Tom. cit., pp. 171–82.

Fungi on Juncaceæ.*—E. Lemmermann has classified all the fungi —a very large number—that are to be found growing on species of Juncaceæ. They belong to the Phycomycetes (1), Ascomycetes (140), Ustilagineæ (13), Uredineæ (12), and to the Fungi imperfecti (60).

Notes on American Fungi.†—Ernst A. Bessey describes carefully the fungus *Dilophospora Alopecuri* which he found on grass leaves. He gives an historical account of the fungus since its discovery by Fries. J. R. Sumstine ‡ records a new American species of *Pleurotus*, distinguished by a thick tomentum; he also describes a form of *Wynnea americana* that differs somewhat from Thaxter's specimens.

American Gooseberry Mildew in Europe.§—Jakob Eriksson records the different outbreaks of this fungus in widely different localities since it was first observed in Ireland in 1900. He gives instances of the way in which the fungus has spread from some central nursery and from imported plants. He recommends that all plants attacked should be at once destroyed, that careful watch should be kept in all nurseries where gooseberry plants are cultivated, and that the importation of these plants from other countries should be prohibited. The spread of the disease is becoming somewhat alarming.

Plant Diseases.—A. de Jaczewski ‖ writes on two forms of disease of gooseberries in Russia, not hitherto recorded. The one forming brown spots on the fruit was due to the hyphomycetous fungus *Alternaria Grossulariæ* sp. n. The fruits attacked dropped without ripening. The other fungoid attack caused the fruits to rot, owing to the penetration of the mycelium into the tissue of the berry. The fungus was diagnosed to be one of the Melanconieæ, *Colletotrichum Grossulariæ* sp. n.

A preliminary note¶ on root disease of sugar cane is published by L. Lewton Brain. The fungus infests the growing point of the roots and interferes with the water supply. It is suggested that it may be related to *Marasmius Sacchari*.

J. Beauverie** contributes a paper on the disease of plane trees, caused by *Glœosporium nervisequum*. The cold spring has encouraged the growth of the fungus, and the planes in the Lyonnais are in a lamentable condition. The disease was confined at first to the leaves; in a later season it attacked the young branches, then the larger branches were invaded, and whole trees have been destroyed. The disease was checked for a year or two by the more favourable climatic conditions, but it has again become virulent. Beauverie recommends cutting off the branches attacked, spraying and powdering young trees not yet attacked, covering wounds by some antiseptic, and instead of propagation by cuttings, saving seed and cultivating new individuals.

* Abh. Naturf. Ver. Bremen, xviii. (1906) heft 2, pp. 465–89. See also Bot. Centralbl., ci. (1906) pp. 632–3.

† Journ. Mycol., xii. (1906) pp. 57–8 (1 fig.). ‡ Tom. cit., p. 59.

§ Zeitschr. Pflanzenkr., xvi. (1906) pp. 83–90 (2 pls.).

‖ Bull. Soc. Mycol. France, xxii. (1906) pp. 121–4 (2 figs.).

¶ Exper. Stat. Hawaiian Sugar Planters' Association, Bull. No. 2, 1905. See also Bot. Centralbl., ci. (1906) p. 649.

** Comptes Rendus, cxlii. (1906) pp. 1551–4.

F. Guéguen * describes a sclerotial disease that attacked the peduncles of *Callisteppus sinensis*. The sclerotia were small black isolated bodies, extending from the surface to the pith. On cultivation the fungus produced simple conidiophores with a head of conidia united in a mucilaginous drop. Occasionally the conidiophores were verticillate.

L. Montemartini † records another case of disease due to *Botrytis vulgaris*. The stalk and leaves of the tuberose (*Polianthes tuberosa*) were invaded by the mycelium of the fungus.

C. V. Piper and S. W. Fletcher ‡ have studied the root diseases of fruit trees, and find that the rot in them is caused by *Armillaria mellea* and an allied form. They suggest methods of cure.

A canker of yellow birch has been demonstrated by J. B. Pollock § to be due to some *Nectria*—probably *N. coccinea*.

Report on the Blast of Rice. ‖ — Haven Metcalf has studied this disease in South Carolina. It causes wounds at the joints of the rice-stalks, and is due to some fungus not determined. It has been called "rotten neck," but the name is only applicable when one of the higher joints is affected. It has caused very great loss in the ricefields of the south. The writer gives data of disease and loss for the various districts, and recommends certain forms of treatment. He gives, also, short accounts of the diseases, smut, rust, damping off, blight, etc.

Myxomonas Betæ.—M. J. Brzezinski ¶ describes at some length this organism, which is a destructive parasite of beetroot, and gives rise to a disease known as "dry rot." The cycle of growth of *Myxomonas Betæ* includes zoospores, myxamœbæ, plasmodia (vegetative), cysts (resting), and spores and zoosporangia (reproductive). It has been studied within the tissues of the beet, and one favourable section may contain all the stages. In the vegetative forms the zoospores are extremely numerous, and gradually become transformed to myxamœbæ, which have a very slow movement. They pass from cell to cell of the host through the cell-wall, and they possess a nucleus which divides by direct division. Several of these myxamœbæ fuse to form the plasmodium, varying in size and position; sometimes it occupies a whole cell, at other times only a corner or centre of the cell. In time the plasmodium breaks up into spores, which germinate and give rise to a zoospore. The cysts are formed either directly by the encystment of one of the myxamœbæ, or from the plasmodium; they are small, brown, smooth, almost spherical bodies. They are formed usually in those parts of the host-plant most subject to drying up. When the dried up stage is passed, they give rise again to myxamœbæ. The zoosporangia are another form of reproduction; they are formed from the plasmodium.

* Comptes Rendus Soc. Biol. Paris, lx. (1906) pp. 411–13. See also Bot. Centralbl., cii. (1906) p. 12.

† Atti Ist. Bot. Pavia, ser. 2, xi. (1905) p. 3. See also Bot. Centralbl., cii. (1906) p. 38.

‡ Bull. Wash. Agric. Exper. Stat., No. lix (1903). See also Bot. Centralbl., cii. (1906) p. 39.

§ Rep. Mich. Acad. Sci., vii. (1905) pp. 55–6. See also Bot. Centralbl., cii. (1906) p. 39.

‖ South Carolina Agric. Exper. Stat., Bull 121, 43 pp.

¶ Bull. Inter. Acad. Sci. Cracovie, iii. (1906) pp. 139–202 (6 pls.).

This organism is closely allied to *Plasmodiophora*. Brzezinski accepts Zopf's classification, which places the forms allied to the Myxomycetes in the Monadineæ. *Myxomonas* would, therefore, be placed in the sub-division, Monadineæ-zoosporeæ.

The condition of the diseased beets is carefully described. The author considers that the well-known disease of beets is due to *Myxomonas*, rather than to *Phoma Betæ* or to *Bacteria*.

BAINIER, G.—**Mycothèque de l'École de Pharmacie. III.-IV.** (Mycology of the School of Pharmacy.)
[A new species of *Trichoderma* is described, and species of *Penicillium*.]
Bull. Soc. Mycol. France, xxii. (1906) pp. 130–7 (2 pls.).

BREVIÈRE, LOUIS—**Contribution à la Flore mycologique de l'Auvergne.** (Contribution to the mycological flora of Auvergne.)
[The list is confined to Ascomycetes.]
Bull. Acad. int. Géogr. botan., xiv. (1905) pp. 185–204, 237–52, 269–72. See also *Bot. Centralbl.*, ci. (1906) p. 631.

BUBAK, FR.—**Einige neue Pilze aus Nord America.** (Some new fungi from North America.)
[The fungi are all microscopic forms.] *Journ. Mycol.*, xii. (1906) pp. 52–6.

CLEMENTS, F. E. & E. S.—**Cryptogamæ Formationum Coloradensium.** (Cryptogamic formations of Colorado.)
[Fungi and lichens are arranged with reference to their ecological relations to a particular region.] *Bot. Centralbl.*, ci. (1906) pp. 631–2.

HÖHNEL, F. VON, & VICTOR LITSCHAUER—**Revision der Corticieen in Dr. J. Schröter's "Pilze Schlesiens" nach seinen Herbarexemplaren.** (Revision of the Corticeæ in Dr. J. Schröter's "Silesian Fungi" according to his herbarium specimens.)
[The authors find some new species among the plants.]
Ann. Mycol., iv. (1906) pp. 288–94 (1fig.).

LISTER, ARTHUR, & GULIELMA—**Mycetozoa from Japan.**
[A list of 29 species from South Japan, with descriptions and notes]
Journ. Bot., xliv. (1906) pp. 227–30.

MORGAN, A. P.—**North American Species of Heliomyces.**
[Diagnoses of the six species of this genus, with index of the species of *Heliomyces* and *Marasmius*.] *Journ. Mycol.*, xii. (1906) pp. 92–5.

PATOUILLARD, N., & P. HARIOT—**Fungorum novorum Decas secundus.** (Second decade of new fungi.)
[These fungi were collected mostly in tropical countries, Java, Africa, Samoa, etc.]
Bull. Soc. Mycol. France, xxii. (1906) pp. 116–20 (1 fig.).

PAZSCHKE, O.—**Rabenhorst et G. Winter, Fungi Europæi et extra-europæi exsiccati.**
[The specimens are from all parts of the world, many of them of great interest.] Editio nova, series secunda, cent. 25 (Leipzig, 1905) Nos. 4401–4500. See also Bot. Centralbl., cii. (1906) p. 100.

REHM, H.—**Ascomycetes exsiccati.**
[Several new forms are issued with this fascicle.]
Fasc. 36 (Munich, 1906) Nos. 1626–50. See also Bot. Centralbl., cii. (1906) p. 15.

SACCARDO—**Notæ mycologicæ. Series VII.—I. Fungi italici. II. Fungi gallici. III. Fungi americani.**
[A number of new species are described; the new genera are *Endothiella* and *Fairmania* (Sphæroidaceæ)].
Ann. Mycol., iv (1906) pp. 273–8.

SACCARDO—**Micromycetes Americani novi.** (New American Micromycetes.) [One new genus, *Bonanseja*, akin to *Stictophacidium*, is included in the list.] *Journ. Mycol.*, xii. (1906) pp. 47–52.

SCHORSTEIN, JOSEF—**Sporenkeimung in Somatoselösung.** (Germination of spores in somatose solution.) [Spores of *Morchella* and of *Xylaria polymorpha* were successfully germinated.] *Ann. Mycol.*, iv. (1906) pp. 295–6 (2 figs.).

WEHMER, C.—**Zur Oxalsäurebildung durch Aspergillus niger.** (The production of oxalic acid by *Aspergillus niger.*) *Centralbl. Bakt.*, xv. (1906) pp. 688–90.

WILL, H., & H. WANDERSCHEK—**Beitrage zur Frage der Schwefelwasserstoffbildung durch Hefe.** (Contributions to the question of the formation of sulphuretted hydrogen by yeasts.) *Op. cit.*, xvi. (1906) pp. 303–9.

Lichens.

(By A. LORRAIN SMITH.)

French Lichens.*—Abbé Harmand has issued the second fasciculus of his work, which comprises the Sphærophoreæ and the Calicieæ. He retains *Sphinctrina* as a genus of Lichens parasitic on the thallus of *Pertusaria*, etc., and the parasitic forms of *Calicium* he also includes as true Lichens. He describes one new species, *Calicium Carthusia*, which grows on bark.

Cladonia rangiferina and Cl. bacillaris.†—Max Britzelmayer has taken up these two species of Lichens, and compared the different authorities on their systematic value. Opinions and diagnoses vary, but he himself recognises both *Cl. rangiferina* and *Cl. sylvatica*, and he gives a long list of forms he has found for each species. He insists also that *Cl. alpestris* should be recognised as a species, and not as a form of either of those discussed. Britzelmayer also considers *Cl. bacillaris* to be an autonomous species, and not a variety of *Cl. macilenta*, and he describes for it a variety of forms, but says the two species are indistinguishable without the help of the reaction with potash. *Cl. bacillaris* gives no reaction.

Dye-stuffs in Lichens.‡—P. Ronceray has published an important memoir on this subject. He gives an historical account of the use of the dyes, enumerates the lichens in which these are found, and which of them are of commercial importance. The dye is composed of lecanorin acid, erythrine, and orcine, and the author gives directions for the extraction and preparation of these substances. He discusses also their probable origin in the lichen ; orcine, he finds, is formed by the fungus, and possibly transformed by the alga into crystalline products ; it is probably an excretion product. The biological conditions that result in the formation of these substances are also discussed.

* Lichens de France, Catalogue systematique et descriptif, Coniocarpés, 1905, pp. 161–205 (1 pl.). See also Bot. Centralbl., ci. (1906) pp. 649–50.
† Beih. Bot. Centralbl., xx. (1906) pp. 140–50.
‡ Paris, 1904, 95 pp. (3 pls. and figs.). See also Bot. Centralbl., cii. (1906) p. 67.

BELEZE, MDLLE.—**Liste des Lichens des environs de Montfort l'Amaury et de la forêt de Rambouillet (Seine-et-Oise).** (List of Lichens from the neighbourhood of Montfort l'Amaury and from the forest of Rambouillet (Seine-et-Oise.)
[The list includes 64 Lichens.]
Extr. Comptes Rendus Congr. Soc. Sav. Sci., 1904.
See also *Bot. Centralbl.*, cii. (1906) p. 40.

OLIVIER [ABBÉ]—**Nouveautes lichéniques.** (New lichenological facts.)
[Some new species and varieties are described.]
Bull. Acad. int. Géogr. Bot., 1905, pp. 205–6.
See also *Bot. Centralbl.*, cii. 1906, p. 66.

STEINER, J.—**Flechten im Fr. Vierhaffer: Aufzählung des von Prof. Dr. Oskar Simony im Sommer 1901 im Südbosnien gesammelten Pflanzen.** (Account of the plants (Lichens) collected by Prof. Dr. Oskar Simony in the summer of 1901 in South Bosnia.)
[The lichens belong to the middle European type of mountain and Alpine flora.] *Mitth. Natur. Ver. Univ. Wien*, iv. (1906) pp. 38–43.
See also *Bot. Centralbl.*, cii. (1906) pp. 67–8.

Schizophyta.

Schizomycetes.

Streptococcus mucosus capsulatus.*—L. Buerger has examined the morphological, cultural, and pathogenic characters of twelve strains of *Streptococcus mucosus capsulatus*, obtained from various sources. The author considers that these organisms should be classified as a special group, and should be distinguished from other streptococci and pneumococci. He discusses the literature and the researches of other authors on the subject.

Streptococcus mucosus.†—Schumacher obtained *Streptococcus mucosus* in pure culture from various unhealthy discharges and from healthy throats. This organism tends to form diplococcal chains, which on artificial media are mostly short, 3–10 cocci, though chains of 60 and more have been counted ; individual cocci are of variable sizes, usually round, but discoid and long cocci are met with ; division takes place in a direction vertical to the length of the chain ; the best staining results are obtained with gentian-violet, fuchsin, or methylen-blue, after fixation in alcohol ; at times the capsule stains so intensely that the cocci are not distinguishable or appear of extra large size ; frequently the capsule is unstained.

On Loeffler's serum, after 15–24 hours' incubation at 37° C. it appears as small pinhead clear water-drop-like colonies ; the growth on ordinary agar is good, and not improved by addition of glucose or lactose ; the colour of Drigalski-Conradi medium is unchanged ; broth cultures are clouded at first, but later clear, with the formation of a thready deposit ; an addition of 2 p.c. of blood improves the growth : no hæmolysis results, but the broth is clouded and takes a greenish colour, the deposit being a brown-violet red ; milk is coagulated within 24–48 hours with the production of acid but no gas ; it is pathogenic to white mice, guinea-pigs, and also rabbits, but these last are more resistant.

The author differentiates this organism from four other streptococci, and gives a table showing the slight variations in cultural characters.

* Centralbl. Bakt., 1te Abt. Orig., xli. (1906) pp. 314 and 514.
† Tom. cit., p. 628.

Bacteria of Mustard Seeds and Table Mustard.*—G. Marpmann describes the characters of two organisms isolated from mustard seeds. 1. *B. sinapivorax* forms milk-white colonies on potato, which later become brown; it forms small star-like colonies on nutrient agar; on ordinary media oval spores are formed after a few days; it causes fermentation in wort, beer, and milk; in a mineral sugar solution, dextrose and galactose are fermented, but lævulose, saccharose, and raffinose are unaffected; in mustard medium there is gas production, with a strong garlic-like odour; the organism is very resistant to drying. 2. *B. sinapivagus* produces brown colour on potato and in broth; it liquefies gelatin; it readily forms spores that are very resistant to drying and to the action of mustard-oil; it does not ferment wort, beer, or milk, and the sugar media are unaffected; in bouillon-agar it produces an odour of trimethylamine.

The author finds that mustard-oil and acetic acid can protect mustard from decomposition; that French mustard prepared with only 2–4 p.c. of vinegar more readily decomposes than German mustard prepared with 5–6 p.c. of vinegar.

Fermentation produced by a Sarcina.†—M. W. Beijerinck describes a sarcina capable of causing fermentation under anaerobic conditions. Broth containing 3–10 p.c. of glucose or extract of malt, and 6–8 p.c. of phosphoric acid, is inoculated with a large quantity of soil, and incubated at 37° C.; after 12 hours there is active fermentation, the resulting gas being a mixture of 75 p.c. carbonic anhydride and 25 p.c. of hydrogen. The glucose may be replaced by cane-sugar, but not by lactose or mannite. Peptone alone serves as a source of nitrogen. The temperature limits vary from 28–41° C.; the most vigorous fermentation is obtained when the process is allowed to take place in a closed flask. Microscopical examination showed a sarcina, the individuals averaging about 3·5 μ, some being larger and allowing the multicellular packets to be visible to the naked eye; they are colourless, and usually transparent and irregular; the organism may be dried without losing its vitality.

Role of Thermophilic Bacteria in the Intestinal Tract of Man.‡—N. N. Anitschkow discusses the literature of this subject, and finds that whereas Globig, by inoculating nutrient media with fæces, in the majority of cases obtained only sterile results, L. Rabinowitsch and Tsiklinski obtained abundant growth of thermophilic bacteria. The author finds that development of thermophilic bacteria is obtained only in rare cases if the nutrient media has not been inoculated with very thick fæcal emulsion in water or broth, and if this infection takes place immediately after the preparation of the emulsion; but if the emulsion is first incubated for 24 hours at 60–66° C., a large number of thermophilic bacteria are developed.

Agglutination and Biological Relationship in the Prodigiosus Group.§—M. Hefferan has examined twenty-two different cultures, ob-

* Zeitschr. angew. Mikrosk., xii. (1906) p. 27.
† Arch. Neerland. Sci. Exact. et Nat., xi. (1906) p. 199.
‡ Centralbl. Bakt., 1te Abt. Orig., xli. (1906) pp. 326 and 426.
§ Tom. cit., p. 553.

tained from strains of nearly allied organisms belonging to the *Prodigiosus* group, obtained from various sources. The author finds that there is a high degree of interaction between those members of the group that are classed together by their sugar-fermenting properties; that there is agglutinative interaction among the members of the group that tend to lose the power of pigment-formation, including one strain that produces only a soluble red pigment; there is much confusion and inequality of interaction among other members of the group that are closely related biologically. The difference between agglutinogenic power and agglutinability is due in some cases to a viscid capsular condition of the bacilli. Readily agglutinable cultures do not possess correspondingly high agglutinogenic power. Experiments to determine the optimum temperature for the agglutination process showed that better results were obtained at either 0° C. or 55° C. than at room temperature or at 37° C.

Plasmoptysis of Bacteria.*—A. Meyer has repeated his own observations and those of A. Fischer, and is of opinion that plasmoptysis as described by Fischer does not occur. Operating with *B. cylindricus* in small hanging drops of water, to which most minute portions of agar from agar cultures of various ages have been added, the author finds that sooner or later there is an active division of the rods which become changed to cocci—which again later (50 hours) become shrivelled and destroyed.

Bacterial Disease of Sesamum orientale.†—K. Malkoff finds that this disease attacks the stalk and leaves of the *Sesamum* plant, causing a black decay. It is produced by bacteria belonging to two distinct species: one forming yellow, the other grey colonies on nutrient gelatin, the latter liquefying the medium within three days, the former causing very slow liquefaction or none at all. Both varieties grow well on sugar agar, and on potato; neither organism coagulates milk, but after eight days the grey colonies peptonise the milk; the bacilli of the yellow colonies are small slightly motile rods covered with long flagella; the bacilli of the grey colonies are longer, and possess a snake-like movement, the flagella being situated only at one end. On examining various portions of the plants at different stages of the disease, it was found that on those more recently attacked the yellow variety predominated, whereas the other variety was more often met with in the later stages of the disease, and especially on the older and thicker stems. The author suggests that these two organisms have a symbiotic existence.

Cytology of Bacillus maximus buccalis.‡—N. H. Swellengrebel, from a detailed study of the cytology of this organism—comprising, besides observation on the chemical and staining reactions, a careful examination of the peculiar cell-division—is of opinion that the spiral filaments seen in the body of the bacillus should be regarded as homologous with the nuclei of higher plants and animals. The author discusses fully the work and opinions of other writers on the subject.

* Ber. Deutsch. Bot. Gesell., xxiv. (1906) p. 208.
† Centralbl. Bakt., 2te Abt., xvi. (1906) p. 664.
‡ Tom. cit., p. 617.

Bacillus isolated from Rhinoscleroma.*—B. Galli-Valerio observed in cover-slip preparations from portions of *Rhinoscleroma* rounded rods 0·6–1·5 μ, lying either free or included within cells; stained with fuchsin and methylen-blue a capsule was noted, but this was absent from preparations made from cultures; the rods do not stain by Gram's method; on agar plates at 37° C. the bacillus formed round raised white colonies; growth on gelatin caused no liquefaction; milk was not coagulated; there was no production of indol; there was slow fermentation of lactose and glucose; inoculation experiments were all negative.

Bacillus paratyphosus B e cane.†—W. N. Klimenko gives an account of a bacillus isolated from the liver and mesentery of a young dog. The author shows how entirely it agrees with the *B. paratyphosus B* and *B. enteriditis* of Gaertner in its morphological and cultural characteristics; but whereas the serum from the dog agglutinated the bacillus in dilutions of 1 : 1600 in 2 hours, it agglutinated *B. paratyphosus B* only in dilutions of 1 : 800 in the same time, and failed to agglutinate *B. enteriditis* even in dilutions of only 1 : 50. The author considers this organism is therefore more closely related to *B. paratyphosus B* than to *B. enteriditis* of Gaertner, and names it *B. paratyphosus B e cane.*

Agglutination Properties of Ficker's Paratyphus diagnostica.‡—S. Minelli finds that the agglutinability of *Paratyphus diagnostica A* and *B*, at room temperatures, after 12 hours was only slightly less than that of young living cultures of *B. paratyphosus A* and *B* under similar conditions. In both cases the agglutinative property was less after 3 hours' incubation at 37° C. The author considers that the *diagnostica* may be of valuable service to clinicians.

Bacillus putrificus.§—Bienstock describes this organism as a strict anaerobe that decomposes albumen with the formation of putrefactive products, H_2S, peptone, leucin, tyrosin, fatty and aromatic acids, amines, etc.; no putrefaction occurs without this organism; it acts only on proteids, not attacking hydrocarbons; it is not pathogenic. When cultivated *in vitro* together with certain intestinal microbes, its property of causing putrefaction is completely arrested, but its growth is uninfluenced. The author agrees with Conradi, who considers that this effect is due to the anti-putrefactive properties of the autotoxins formed by the *B. coli*, and he believes that it is owing to this antagonistic action of *B. coli* that he was never able to detect the presence of *B. putrificus* in the stools of healthy persons.

Relation of the Sensibilisatrice (amboceptor) to the Alexine (complement).‖—J. Bordet and F. P. Gay agree with Ehrlich and Sachs that the blood-cells of the guinea-pig are hæmolysed in a mixture of fresh horse-serum and ox-serum previously heated to 56° C., although they can resist this if they are subjected successively to the contact of ox-serum and horse-serum. The interpretation proposed by Ehrlich

* Centralbl. Bakt., 1te Abt. Orig., xli. (1906) p. 645.
† Tom. cit., p. 617.
‡ Tom. cit., p. 583.
§ Ann. Inst. Pasteur, xx. (1906) p. 407.
‖ Tom. cit., p. 467.

and Sachs, according to which the sensibilisatrice (amboceptor) furnished by the ox-serum only unites with the blood-cell when first combined to the alexine (complement) provided by the fresh horse-serum, the authors consider as inexact; for the preponderating amboceptor belongs to the horse-serum and not to the ox-serum; and the amboceptors do not require the presence of an alexine to enable them to unite with the blood-cells. The authors consider that Ehrlich's interpretation neglects an essential factor, viz. the intervention of a special substance of a colloid and albuminoid nature peculiar to ox-serum, resisting heating to 56° C., and having the power to be attracted by the cells charged with amboceptor and complement, although remaining free in the presence of normal cells or of those holding only amboceptors. The absorption of this substance by the cells causes energetic agglutination, and renders them more readily hæmolysed. The absorption is probably due to molecular adhesion, the adhesive properties of the cells being modified by their previous treatment.

Bacillus phytophthorus.*—G. Delacroix finds that the black stem-rot of potatoes, a disease occurring in spring, is due to *B. phytophthorus*, a short bacillus, almost a coccus, which rapidly liquefies gelatin. Like *B. solanincola*, it is invariably found associated with the mycelium of *Fusarium*.

Granulation of Vibrios.†—G. Q. Ruata investigated the cause of the granulation which occurs in old cultures of vibrios (choleric and choleriform), and selected for experiment *V. Metchnikowi*. His general results amounted to this, viz. that all substances which render the medium unfavourable for their vegetation and enfeeble their growth, cause the production of the granulation; among the causes cited are alkalis, acids, ether, chloroform.

CALMETTE, A., & C. GUÉRIN—**Origine intestinale de la tuberculose pulmonaire et mécanisme de l'infection tuberculeuse.**
[In this, the third contribution, the authors advance further experimental proof that tuberculosis of the lungs is of intestinal origin.]
Ann. Inst. Pasteur, xx. (1906) pp. 609–24.

* Comptes Rendus, cxliii. (1906) pp. 383–4.
† Ann. Inst. Pasteur, xix. (1905) pp. 661–72.

MICROSCOPY.

A. Instruments, Accessories, &c.*

(1) Stands.

Old Microscope by Pritchard.—This Microscope (fig. 64) was exhibited at the June Meeting by Mr. J. T. Holder. It was made for T. N. Ray in 1846, and now belongs to Mr. W. R. Reeves, of Liverpool, who kindly lent it for exhibition. It appears to be a modification of Pritchard's "Solid Tripod-stand Achromatic Microscope and Engiscope," described and figured in his "Microscopic Illustrations."

As may be seen from the figure, it consists of a telescopic pillar, the outer tube of which is screwed into a solid tripod-foot; the inner tube is surmounted by a rule-joint, to which is attached a hollow tail-piece upon which slide the stage and mirror. A triangular bar, with a rack cut on its posterior edge for the coarse-adjustment, passes down the inside of the tail-piece, and a short arm for carrying the body is attached to the top of the triangular bar by means of a screw, about which the arm with the body can be rotated and secured in any required position.

The body is about $7\frac{1}{8}$ in. long and $1\frac{1}{4}$ in. diameter inside. The fine-adjustment is very simple, consisting of a micrometer screw having a conical point which acts on the nose-piece against the pressure of a spring.

It may be mentioned that there is no difficulty in focusing the $\frac{1}{8}$-in. and the $\frac{1}{18}$-in objectives by the coarse-adjustment, and this was done at the Meeting, the fine-adjustment then being detached.

The stage is mechanical, and has a transverse movement effected by a screw, and a movement in arc at right angles to the transverse one. Each motion is limited to half an inch.

The stage is composed of three plates, the lowest being fixed. The middle plate carries the upper plate and its traversing screw, and is pivoted on the fixed plate at the left-hand side. The milled head of the traversing screw projects on the right-hand side and serves as the handle of a lever, consisting of the traversing screw and the upper plates, to give the movement in arc. It is thereby easy to give the stage the two motions simultaneously. A so-called "safety slider-holder" is mounted on the mechanical stage: it can be removed when using low powers, but it is necessary when using the higher powers for focusing the objective upon the object, as the body cannot otherwise be racked down sufficiently.

* This subdivision contains (1) Stands; (2) Eye-pieces and Objectives; (3) Illuminating and other Apparatus; (4) Photomicrography; (5) Microscopical Optics and Manipulation; (6) Miscellaneous.

The stage can be moved up or down on the tail-piece, and can be turned to one side for various purposes, the chief apparently being that of using the "spring-phial-holder"—a device of Varley's for retaining a phial in an upright position when examining objects under water.

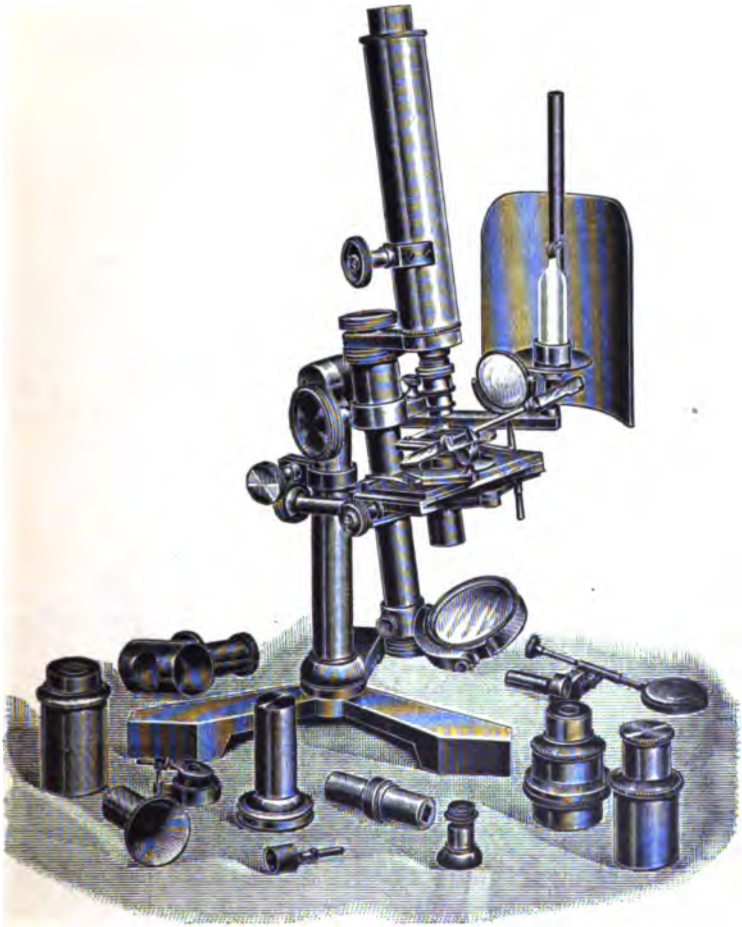

FIG. 64.

There is a sub-stage fitting for carrying a polariser, and there is also an adapter for carrying an analyser over the eye-piece.

There are eight objectives—2 in., $1\frac{1}{4}$ in. (?), 1 in., $\frac{1}{2}$ in., $\frac{1}{4}$ in., $\frac{1}{8}$ in. with collar adjustment, $\frac{1}{10}$ in., and $\frac{1}{18}$ in. | The 1 in. and $\frac{1}{2}$ in. are marked A, the $\frac{1}{4}$ in. is marked B, and the $\frac{1}{10}$ in. and the $\frac{1}{18}$ in. are

marked C. In reference to this Pritchard says ("Microscopic Illustrations"): "The above sets may be divided into three classes—the shallow, medium, and deep; which, like the eye-pieces, I shall particularise by the letters A, B, C." From the above marks it may be concluded that $\frac{1}{10}$ in. and all above are classed as C, from $\frac{1}{10}$ in. to $\frac{1}{2}$ in. as B, and $\frac{1}{2}$ in. and below as A. The 1 in., $1\frac{1}{4}$ in. (?), and 2 in. have lieberkuhns.

According to a table in "Microscopic Illustrations," the working distance of the objectives is: for the 2 in. = $2\frac{1}{3}$ in.; 1 in. = $1\frac{1}{8}$ in.; $\frac{1}{2}$ in. = $\frac{3}{8}$ in.; $\frac{1}{8}$ in. = $\frac{1}{20}$ in.

There are five oculars, two having micrometers, one being a simple scale engraved on a thin slip of mother-o'-pearl. There is an arrangement for focusing the eye-lens on the micrometer scale. The other micrometer eye-piece is ruled in squares for use in making drawings.

Among the apparatus is a camera-lucida, a dark well, some live boxes (one with a scale engraved on the bottom of the cell), and a candlestick or lamp-holder, shade, and brackets. Of the candle-holder Pritchard seems to have been rather proud.

There is an additional body, about 8 in. long and about $1\frac{7}{16}$ in. internal diameter, but there is neither fine-adjustment nor any means of fixing the body to the stand, though at one time there was doubtless either another arm, or an adapter, to enable it to be screwed into the existing arm.

There are three oculars belonging to this body, one having a micrometer ruled in squares, with a collar arrangement for focusing it to the eye-lens, another ocular has a double eye-lens, the outer one being a meniscus.

There is also an adapter for applying the analyser above the objective.

The figure shows the stand with the candlestick and shade in position. To the left at the back is the "spring-phial-holder," and just in front of the foot is the camera-lucida; near the middle in the foreground is a dark-well and the polarising apparatus—polariser and analyser screwed together; near the point of the right foot is the micrometer ocular belonging to the large body; the other items are a selection of the objectives and oculars.

Mr. Nelson is of opinion that the instrument was undoubtedly made by Hugh Powell for Pritchard, and he calls attention to the spring joints to the mirror. This device for spring joints was used by Powell as early as 1831, and is still used by Powell and Lealand.

Zeiss' Martens Stand.—The special Microscope (fig. 65) for metallurgical work, constructed by Messrs. Carl Zeiss, Jena, in accordance with the suggestions of Professor Martens and Engineer E. Heyn, of the Königliche technische Versuchsanstalt, Berlin, consists of a solid base so arranged that it can be fastened to a sole-plate on an optical bench. The stand is chiefly constructed for photomicrography, and is not inclinable. The mechanical stage is attached to a movable dovetailed slide provided with a rack-and-pinion and a micrometer screw for fine-adjustment, by means of which the objects can be focused

without altering the position of the body-tube of the Microscope, thereby not disturbing the adjustment for illumination with the vertical illuminator for various powers. A Hooke's key is attached to the micrometer movement, so that it can be worked from behind the camera. The upper portion of the Microscope carrying the wide body draw-tube is also of special construction, to insure rigidity. It is provided with

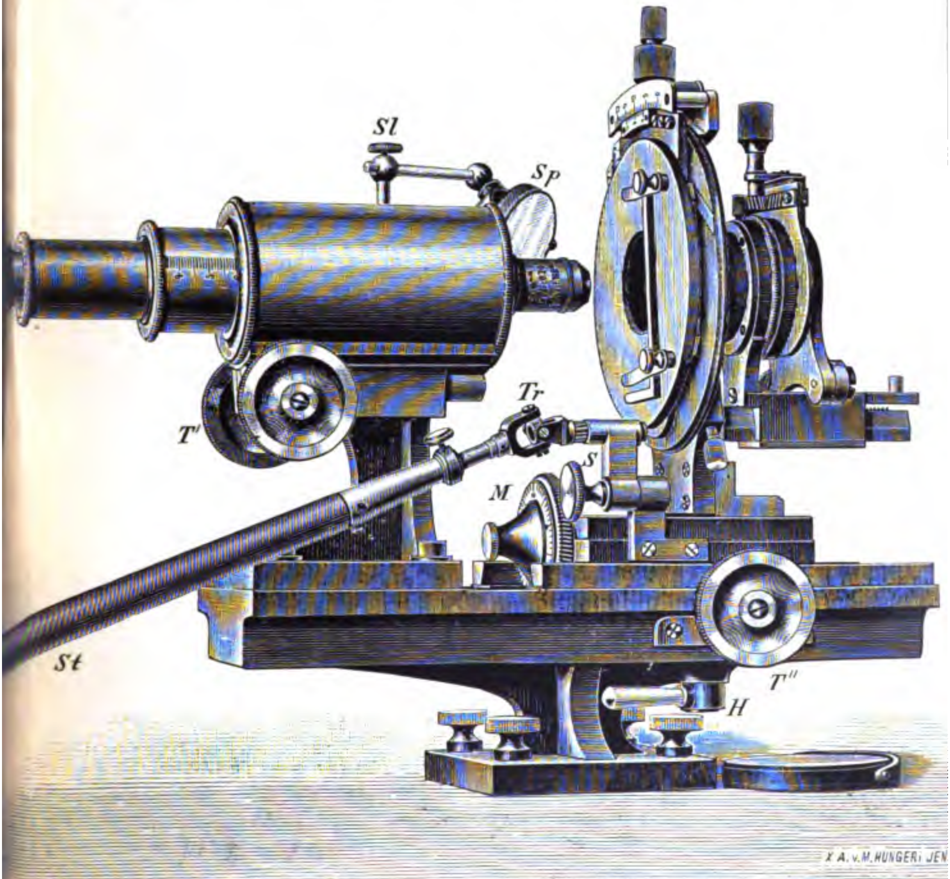

FIG. 65.

rack-and-pinion and clamping screw, and also with an illuminating device facilitating vertical illumination for very low-power work. For high-power work, a vertical illuminator is supplied, consisting of a totally reflecting prism specially mounted and fitted with an iris diaphragm. The vertical illuminator is so arranged that it can be rotated round the axis of the Microscope, and as the totally reflecting

prism can also be rotated round its own axis, vertical illumination with high powers is greatly facilitated. The iris diaphragm, which is mounted in front of the totally reflecting prism, serves for the purpose of excluding stray light. As the body-tube of the Microscope, as well as the stage, can be moved, an extremely wide space between the objective and the stage is available. No screws of the mechanical stage project above the level of the stage, so that the objects can be illuminated with extremely oblique light. The tube is of extra width, to allow the use of very low powers without cutting down the field. An Abbe substage condenser can be fitted to the stage if required. Plate-glass reflectors, as well as mirrors of different diameters for various kinds of illumination, are provided for.

R. and J. Beck's "Class" Dissecting Microscope.—This is a strong and convenient instrument of great rigidity, specially adapted for use in the laboratory (fig. 66). It is made in mahogany, with a rack-and-pinion focusing adjustment and a double mirror; the sides form substantial hand rests; the lenses fit into a double-jointed arm, so that a large

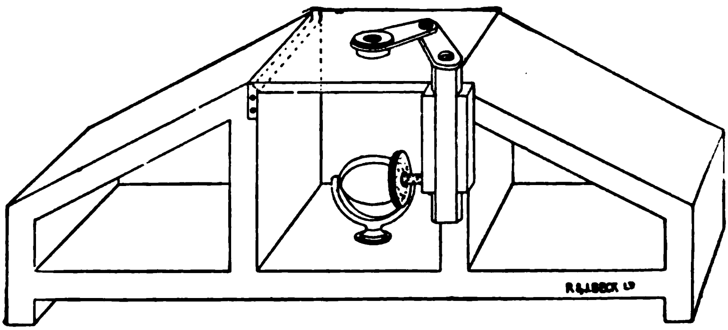

FIG. 66.

area of surface can be examined; a glass plate $4\frac{1}{2}$ by $4\frac{1}{2}$ in. forms the stage, and this can be replaced by an opal or vulcanite plate if required. The length of the instrument is 15 in., breadth 5 in., height to stage $5\frac{1}{2}$ in. A complete set of lenses and achromatic triplets—and also a small compound Microscope magnifying about 30 diam., which can be dropped into the arm for detailed examination of an object—is supplied if required.

GAIDUKOV, N.—**Die neue Zeisschen Mikroskope.**
[A review of the instruments in Catalogue No. 33, 1906, of Carl Zeiss, Jena.]
Zeitschr. wiss. Mikrosk., xxiii. (1906) pp. 59–67 (4 figs.).

(2) Eye-pieces and Objectives.

Simple Compensator Ocular.*—A. Pauly points out that a compensating ocular suitable for most practical requirements can be easily

* Zeitschr. wiss. Mikrosk., xxiii. (1906) pp. 38–41.

constructed out of a Huyghens' ocular. For this purpose a glass micrometer is to be placed on the diaphragm, the divided face being underneath. A selenite or quartz wedge is attached to the micrometer with Canada balsam. This wedge, which affords an easy means of obtaining the colours of higher order, is compensated by a selenite plate of such a kind that the iron-grey of the first order, the zero value of the interference colours, overlaps an initial point of the micrometer scale. It is necessary to take care that the wedge has a uniform constant inclination angle of 1° to 2°, and that in the combination of the two selenite plates the axes of elasticity are accurately perpendicular to one another: thus a_1 of the wedge is parallel to c_2 of the plate, and c_1 of the wedge is parallel to a_2 of the plate. The wedge must be so cemented to the glass micrometer that the interference bands are parallel to the scale divisions. The whole is covered with a circular cover-glass of such a size that it will go into the ocular. The test is made with sodium light, and the operator reads the number of micrometer divisions from one dark band to the next. The wave-length (0·000575 mm. for Na) is divided by the number of divisions observed. This calculation gives the value of the phase-difference for one division of the scale. In order to measure the double refraction of a given body placed on the object-stage, an ocular of suitable strength, equipped as already described, is inserted in the ordinary way in the tube and the analyser applied over it. The object is then pushed along the scale until it has compensated any particular position of the interference bands. It is necessary then to bring the object into just such a position that the axes of elasticity form 45° with the Nicol sections, which is easily controlled by the adjustment of the micrometer scale, and then to rotate through 90° so that the a axis of the selenite wedge lies over the axis of less elasticity (c) of the object. The position, as found for compensation, is read off on the divisions of the micrometer scale, and the number of divisions (from zero of the interference colours) is then multiplied by the phase-difference for one division. It is possible to compensate approximately with ordinary light and then accurately for monochromatic. The author gives some numerical examples.

(3) Illuminating and other Apparatus.

New Projection Drawing Board.*—A. C. Pohlman's arrangement consists of an upright frame surmounted by three axles, each carrying a reel of paper. The gearing is such that one or all of the reels may be in action, and a crank in the lower part of the machine actuates a roller for rolling up the paper wound off the reels. The paper in its descent lies flat against a vertical board and receives the projected image. Means are provided for keeping the paper taut. A brass bar acts like a knife edge, and thus single drawings can be removed. If a series is required the lower roller winds up the drawings. There is an arrangement by means of which two sheets of double-sided blue copying paper can be

* Zeitschr. wiss. Mikrosk., xxiii. (1906) pp. 41–44 (3 figs.).

introduced between the layers of drawing paper: it is then possible to get three normal and three right for left drawings at one operation.

Leppin and Masche's Mirrormegascope.*—The intention of the

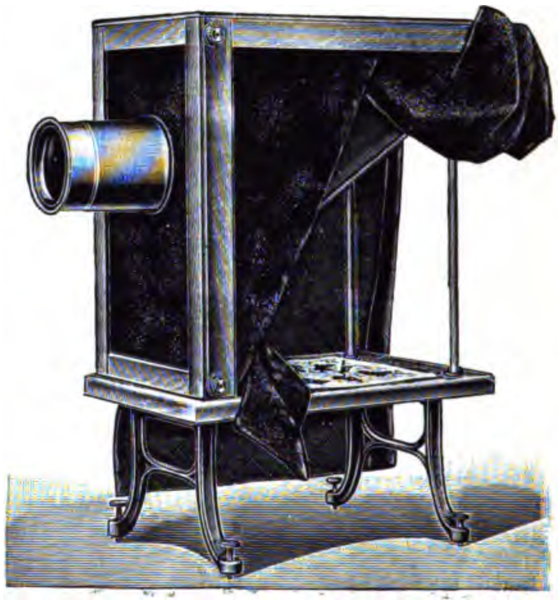

FIG. 67.

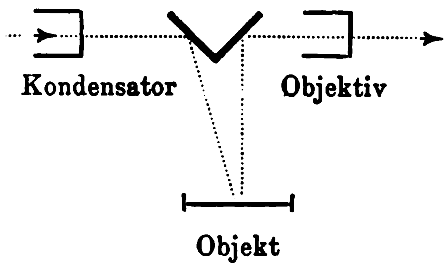

FIG. 68.

designers was to produce an inexpensive portable apparatus for the projection of opaque objects (fig. 67). The light from a suitable strong source falls on a mirror, silvered on face, set at 45° to the optical axis,

* Zeit. f. ang. Mikrosk. u. klin. Chemie, xii. (1906) pp. 1-5 (2 figs.).

and is thence reflected on to the object beneath it. The strongly illuminated object is now reflected on to a second and similar mirror likewise at 45° to the optical axis but at right angles to the first (fig. 68), and after incidence on the objective is projected on to the screen. The objective has a diameter of 120 mm. The whole apparatus is inclosed in a frame with plush curtains resembling a camera. The designers say that it is very suitable for projecting drawings, insects, butterflies, or for such an object as a live fish in water.

Simple Illuminating Apparatus for Loup Preparations and for Microscopy.*—O. Bender has found his contrivance (figs. 69 and 70)

Fig. 69.

very useful, as it enables an operator to be independent of variable daylight. He fits a bent metal arm to the rod of an ordinary Microscope lamp (or incandescent gas jet) with opaque cylinder. This metal arm carries a plane mirror inclined at 45° to the path of the beam emergent from the orifice of the cylinder. The light after reflection at the mirror travels down on to the loup, fixed in a ring jointed on the arm, and thence impinges on the object. The arm carrying the ring can also be

* Zeitschr. wiss. Mikrosk., xxiii. (1906) pp. 36–38 (2 figs.).

inclined to the vertical so that oblique illumination of the object may be obtained. By using a cylinder with an interior white glazed surface the

FIG. 70.

beam of light is intensified. A sheet-iron screen is also attached to the arm so that the operator's eyes are shielded from the rays.

(4) Photomicrography.

Interferential Photography; Variation of Incidence; Polarised Light.*—M. Ponsot has studied experimentally the interferences of polarised light reflected from a plane mercury surface, the interferences being produced in the thickness of a transparent layer of gelatino-bromide of silver in contact everywhere with the reflecting surface. He was, in reality, repeating Wiener's experiments with, as a variation, Lippmann's arrangement for interferential photography. His experiments were made with (1) non-polarised light; (2) polarised light; (3) without the mercury mirror.

1. *Non-polarised Light.*—Photographs of the spectrum were taken under normal incidence and under increased incidence, notably at 45° in air, which gives an incidence (i_1) of about 28° in the gelatin. To get an incidence of 45° in the gelatin a right-angled isosceles prism of crown-barium (1·55 for yellow light) was used. The examination in white light, under normal incidence, of the photographs shows that the spectrum colours are displaced towards the violet, and the more so as i_1 is increased. Under an increasing incidence the colours are displaced towards the red. These results are in agreement with theory, and bear upon the choice of objectives in interferential photography as regards regulating the working distance for getting the maximum effects with the active colours.

2. *Polarised Light.*—The results obtained are identical with the

* Comptes Rendus, cxlii. (1906) pp. 1506-9.

preceding, as far as the displacement of the colours is concerned. If the light is polarised in the plane of incidence, the colours observed are very brilliant, and purer than with white light. If the light is polarised in a plane perpendicular to the plane of incidence, the colours become more and more dull. For an angle of 45° in the gelatin they disappear entirely, and are replaced by a uniform yellowish tint due to the reflecting silver produced by the development.

3. *Without the Mercury Mirror.*—The results are, in all cases, analogous to the foregoing. For $i_1 = 45°$ there is total reflection at the gelatin-air surface; with light polarised in the plane of incidence the photograph gives beautiful colours in the region affected by the blue; in the other case there are no colours, but a reflecting surface of yellowish silver.

The author has noticed that under the same conditions of exposure and of light the colours seen at any point of a plate are not the same as with a reflecting mercury surface.

Photography of the Absorption Rays of the Colouring Matters of Blood.*—L. Lewin, A. Miethe, and E. Sterger have overcome the technical and experimental difficulties connected with this investigation. They have examined the blood of human beings, horses, pigs, rabbits, frogs, and of earthworms; also pure oxy-hæmoglobin and its products of transformation; also colouring matters derived from the blood. The apparatus used comprised a spectrograph with a Thorpe grating giving a a spectrum of 9 cm. long between wave-lengths 800 and 300. A quartz spectrograph was used for the ultra-violet to see if the absorption rays existed beyond 300. The luminous source was ignited threads of magnesium, which not only gave a very clear regular light, especially in the violet and ultra-violet parts of the spectrum, but also some very sharp lines serving to locate the absorption bands. In some experiments the oxy-hydrogen-zirconium light was used, and in the less refrangible parts a Nernst lamp. The liquids were contained in small vessels with parallel sides or in test-tubes of known diameter. These latter acted at the same time, if thought desirable, as convex lenses.

Production of Stereo-Photomicrographs.—W. P. Dollman writes that the following revision of his method† covers both high- and low-power work.

"The methods of producing stereo-micrograms are comparatively simple. In an article by the late Mr. J. Traill Taylor in the 'British Photographic Journal Almanac' for 1894 are described several methods of doing this work, one of the simplest of which is that of obscuring by a semicircular screen half of the objective in use, and using alternately the right and left hand (or upper and lower if the plate is upright in the camera) halves respectively for the two images required for the stereoscope. For this method may be substituted a plate with an eccentric circular aperture, as giving superior definition to a semicircular opening. Placing a plate in front of the

* Comptes Rendus, cxlii. (1906) pp. 1514–16.
† See this Journal, 1906, p. 257.

objective is inapplicable for any but opaque objects lighted in front, it being difficult to secure approximately even illumination by this means of transparent objects lighted from behind.

"In the case of photographic objectives—I have used these of from 2-in. to 6-in. focus—an eccentric diaphragm of thin blackened brass can be placed against the diaphragm between the combinations, and this is certainly the better place for the screen. I have used a 2-in. focus Dallmeyer portrait combination (which is specially good for this work), a 4½-in. Unar, and a 6-in. Goerz.

"Of course, for low magnifications of a rough object it is advisable to work with a low power—the 4½-in. focus lens was used for most of my earlier work — but for larger objects a 6-in. lens would define better. The little Dallmeyer is a marvel for definition and flatness over the small field used. I have had extra tubes made for my Microscope (a Van Heurck by Watson) to take the place of the lower rackwork tube and the upper sliding tube, which carry the photographic lenses—the Dallmeyer at the bottom of the draw-tube, the Unar (for which I had a new mount made so as to get it inside the tube) about 1½ in. down the tube from the top, and the Goerz outside at the eye-piece end of the Microscope. These adaptations enable the lenses to be carried at the suitable distance from the object on the stage, and allow sufficient rackwork for focusing. As the major conjugate focus of the objective is used in Microscope work, all non-symmetrical photographic lenses, such as 'Unars,' 'Stigmatics,' and portrait combinations, should be reversed on the Microscope (the front combination being presented to the plate) to enable them to perform at their best.

"When the distance is too great (as it will be in low-power work) for the hand to reach the focusing pinion, I use a Hooke's universal joint focusing rod, but for the higher powers I have a long rod on the other side (the right) with a pulley-wheel near the end, over which and the fine-adjustment screw-head runs a cotton-thread loop, which is quite effective even with a $\frac{1}{12}$-objective.

"In photographing transparent objects, and for high-power work, I use light of varying obliquity for the two halves of the plate, and the getting the two halves into proper position on the plate is a rather complicated business, as I use two different methods of obtaining oblique light (each of which necessitates a different position of the plate in the slide), and sometimes dispense with the eye-piece (which requires the reverse position of the plate to that when the eye-piece is used). I have to keep a memorandum sheet by me to prevent my making mistakes when at work. For high powers, less obliquity of the light is necessary than for medium or low powers, and in this case the condenser may be moved laterally, but for medium and low powers an eccentric diaphragm in the revolving cell under the condenser is a convenient mode. I have had five diaphragm-carriers made to fit the revolving cell under the substage condenser, with apertures at different distances from the centre— ½, 1, 1½, 2, and 3 mm. Into these apertures drop plates, ten in number, with openings from 1¾–20 mm. Thus there are fifty changes of aperture and distance from centre, which will meet all demands for high- and low-power work.

"The camera I use is a whole-plate one, with a long bellows, with, for long-distance work, a telescopic attachment in front (made of rolled brown paper). The upright position of the plate in the camera is the more convenient for photographing opaque objects requiring to be lighted from the front and side, and the objective should be divided horizontally. This also applies to the oblique light method.

"The reversal of the image on the plate—so that the print will not require to be divided, and simplifying the mounting—may be effected by using a carrier in the dark slide (the whole-plate slide allows this to be done) in which the plate (5 in. by 4 in.) can be placed 2¼ in. out of the centre, so as to receive the image from the right-hand (or upper) half of the lens on the left-hand (or lower) half of the plate.

"Where a diatom does not present its best aspect through being turned the wrong way, the images may be reversed, so as to get a pseudoscopic effect, which renders the object as though photographed from the other side by turning it inside out.

"The opening in the carrier should be 7¼ in. by 4 in., a piece of glass 2¼ in. by 4 in. filling the otherwise unoccupied end. A screen (of blackened card or thick paper) with an aperture in the centre of 2⅛ in. by 3 in. should be placed in the carrier to protect one-half of the plate while the other half is being exposed. After exposing one side of the plate, the slide is taken into the dark room, and the plate moved to the other end of the carrier. Then the screen on the objective is moved half round, or the eccentric diaphragm under the condenser is given a semi-revolution (or, in the case of a lens in the draw-tube, the tube is given a semi-revolution without disturbing the focus), and the second exposure can be made.

"An important thing to remember when photographing opaque objects is that, to secure even illumination of the two halves, the illuminant must be on the same level as the centre of the objective—this is why the horizontal division of the objective and the upright position of the plate are recommended.

"For the lighting of large transparent objects, when using the lowest powers, I have had a cell, which carries a 4½-in., 6-in., or 8-in. focus uncorrected condenser, fitted to the large aperture under the main stage of the Microscope, and brought as near as possible to the object. For the smaller objects I use an achromatic condenser of 1·0 N.A. This can be altered in power by removing the top combination, or, if necessary, using only the lowest of the three lenses. As illuminant, I use acetylene (the finest light for all ordinary work), from a special burner I had made, limelight, and sometimes sunlight (parallel rays) through a heat-absorbing medium. On the platform carrying the apparatus there is a scale from 0 to 49 in., with the zero in a line with the Microscope stage. This, with the aid of tables for the various lenses used, enables me to work to definite magnitudes.

"Exposure, of course, depends upon colour or brightness of object, illumination, and magnification, and may vary from a few seconds to an hour.

"I use ordinary developers—such as would give a hard result to accentuate feeble contrasts. Orthochromatic plates, with or without a

yellow screen, are used; and when monochromatic light is desirable, a suitable light-filter is utilised. I have used 'zenith' and 'imperial sovereign' plates for high-power work not needing an orthochromatic plate, and so reduced the exposures materially."

GLASENAPP, M.—**Die Bedeutung der Spitzertypie für die Reproduktion von Mikrophotographien.** (An appreciation of the advantages of Spitzertype for the reproduction of photomicrographs.)
Zeitschr. wiss. Mikrosk., xxiii. (1906) pp. 174–82 (8 figs.).

(5) Microscopical Optics and Manipulation.

Ultramicroscopical Examination of Plant-cells.*—N. Gaidukov made an examination of the crushed-out contents of a *Vaucheria* cell. The object was placed between a glass slide and a cover-slip in the usual way, but great pains were taken to secure purity of the media and cleanliness of the glass. The apparatus was arranged according to Siedentopf's method. The result was a clear distinction between the corpuscles of chlorophyll and of plasma, the diffraction-disks of the former being usually red and green, those of the latter being white and blue. It was possible to watch the formation of a colloidal solution of chlorophyll with oil, for the drops of the former were attracted by, and seemed to disappear in, the oil-drops. Observations were also made on certain other plant-cells.

Dispersion in Electric Double Refraction.†—H. L. Blackwell, after an historical sketch of the labours of previous experimenters on this subject, describes the new results obtained by himself. Temperature and field-strength being kept constant throughout an experiment, the observed double refraction, or separation (δ), is proportional to the difference between the ordinary and electrically-produced extraordinary indices of the liquid ($\mu_e - \mu_\omega$). This quantity is the separation in centimetres introduced between the mutually perpendicular components of a wave of plane-polarised light in traversing 1 cm. of the substance in question—in this case carbon bisulphide—at a certain temperature in a field of certain strength. The double refraction of naturally uniaxial crystals is usually similarly expressed as the difference between the two indices. The factor necessary to reduce this value to absolute index of refraction was found to be about $7 \cdot 04 \times 10^{-7}$. Observations were terminated in the violet by the absorption of the liquid. At wave-length 4180 the spectrum was still very bright; at 4144 very faint. The experiments do not confirm Kerr's law, and it may be that the approach to an absorption band is the controlling factor rather than the change of wave-length.

Arrangement for Simultaneously Obtaining Minimum Deviation with Several Prisms.‡—P. Lambert, having had occasion to mount a spectroscope composed of three prisms and of two half-prisms in such a manner that the luminous ray after once traversing the system should return upon its path after incidence at a mirror, was led to study the

* Ber. Deutsch. Bot. Ges., xxiv. (1906) pp. 107–12.
† Proc. Amer. Acad. Arts and Sci., xli. (1906) pp. 647–67 (1 pl. and several figs.).
‡ Comptes Rendus, cxlii. (1906) pp. 1509–11 (3 figs.).

conditions necessary for obtaining minimum deviation. Although several mechanical arrangements have been designed for meeting the difficulty, none of them appeared applicable to his requirements, as they either require too much space or fail in precision. He believes that his method is novel. It is known that, if the prisms are once in the desired position, their edges being truly vertical, their bases will form the sides of a regular polygon inscribed in a circle. If one of the half-prisms be fixed, the author shows that the displacement of the centre of the circle is along a certain straight line, and that, corresponding to a displacement of the centre, the bases of the prisms must always be tangents to a circle of certain radius described with that centre. The author shows how, by means of pulleys and flexible cords, this adjustment can be readily obtained.

(6) Miscellaneous.

Gotch Ophthalmic Spinthariscope.—This instrument (fig. 71), which is made by the firm of R. and J. Beck, has been designed by Professor Gotch, of Oxford, its purpose being to afford a ready means of testing the retinal excitability of the dark adapted eye and the alterations in retinal sensitiveness which are produced by light. The instrument contains a small quantity of radium held on the further side of an adjustable opaque pointer, an adjustable fluorescent screen of zinc-blende, a series of diaphragms for limiting the field of view, and a lens for focusing the scintillating flashes which occur on the screen through the emanations from the radium. The main features of the instrument are as follows. A handle F allows the instrument to be held in the hand of the observer without danger of altering the adjustments. The lens A through which the fluorescent screen E is viewed is capable of being adjusted by revolving the milled collar B so as to secure accurate focusing. The pointer carrying the radium lies within the tube in front of the screen E, and is fixed upon a graduated slide C, by means of which it can be withdrawn from the centre of the tube to any desired distance up to 20 mm. Between the pointer and the focusing lens is a second graduated slide D, which is provided with a series of circular apertures of different sizes, so that the visual field can be varied in size. When the slide D is pushed quite in, the fluorescent screen is completely covered, so that when not in use it is protected from light entering the tube through the eye-piece. The fluorescent screen E can be

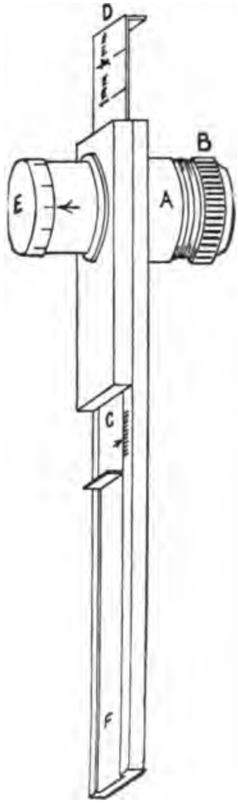

Fig. 71.

removed further from or brought nearer to the radium by means of the milled head on its circumference; each complete turn of the screw removes the screen 1 mm., and the head being marked in tenths of its circular distance allows a variation of tenths of a millimetre; the screen, when placed its nearest position, is 1 mm. from the radium.

BRASS, DR. A.—**Der Scheiner'she Versuch.**
[An historical article on the optical work of Professor Scheiner, S.J., of Ingolstadt, who lived at the beginning of the seventeenth century.]
Central.-Zeit. f. Opt. u. Mech., xxvii. (1906) pp. 163–5 (1 fig.).

WEINSCHENK, E.—**Anleitung zum Gebrauch des polarisationsmikroskops.**
Freiburg: Herder, 2nd ed., enlarged and revised, 1906, viii. and 148 pp., 135 figs.

B. Technique.*

(1) Collecting Objects, including Culture Processes.

Anaerobic Nitrogen-fixing Organisms.†—E. Haselhoff and G. Bredemann have examined various soils and leaves of different trees—birch, oak, beech, etc.—and found anaerobic nitrogen-fixing organisms in almost every case. The material was placed in water, heated for three minutes at 80° C., and then placed in Winogradsky's nitrogen-free medium in a nitrogen-containing atmosphere, and incubated at 28° C. From these rough cultures pure cultures were obtained. Cultures were also obtained in flasks through which nitrogen was conducted, the amount of the nitrogen fixed being estimated by comparing the nitrogen content of the flask before and after the fermentation produced by the organism. The five different *Clostridia* cultivated from the soil and foliage were very similar, but none were identical with *C. pasteuri*.

Use of the Sodium Salt of Nucleinic Acid in Bacteriological Diagnosis.‡—A. Pepere finds that the solid media of liver-broth gelatin, to which has been added the sodium salt of nucleinic acid, affords a certain means for the differential diagnosis of *B. typhosus* and *B. coli*. In the case of *B. coli* the medium is readily liquefied, whereas in the case of *B. typhosus* not the slightest peptonising action occurs.

Culture of Treponema pallidum.§—G. Leuriaux and V. Geets obtained cerebro-spinal fluid by lumbar punctures under strict asepsis, from cases of secondary syphilis, and, after adding neutral pepton broth, incubated the mixture at 37° C. for 3–4 days. Hanging drops from these cultures showed the presence of minute rapidly-motile corpuscles. The liquid was centrifuged for 20 minutes, and the deposit inoculated on solid pig serum. After 3–4 days there appeared on the surface of the medium an ivory-white moist sticky layer, with a strongly alkaline odour. Out of forty-two punctures three typical cultures were obtained. Cover-slip preparations from 5-day old cultures were stained by Giemsa's

* This subdivision contains (1) Collecting Objects, including Culture Processes; (2) Preparing Objects; (3) Cutting, including Imbedding and Microtomes; (4) Staining and Injecting; (5) Mounting, including slides, preservative fluids, etc.; (6) Miscellaneous.

† Bot. Zeit., 2te Abt., 1906, p. 234.

‡ Centralbl. Bakt., 1te Abt. Ref., xxxviii. (1906) p. 267.

§ Centralbl. Bakt., 1te Abt. Orig., xli. (1906) p. 684.

method. The authors consider that the organism is derived from an oval globule which corresponds to the *Cytorrhyctes luis*, passes through a phase resembling a trypanosome, and subsequently attains the form of a *Treponema* as the result of an agamous multiplication of the macrogamete (trypanosome).

Cultivation of Glanders.*—M. Nicolle made a nutrient agar of the following composition. 500 grm. of finely chopped meat were macerated for one night in 1 litre of water. 500 grm. of coarsely cut potato were macerated for a similar time in 1 litre of water. The two fluids were mixed, and 20 grm. of Chapoteaut's pepton, 10 grm. salt, 20 grm. glycerin, and 20 grm. agar added. After sterilisation and alkalisation the condensation water is removed by placing them in the incubator before capping. This medium is suitable not only for glanders, but also for any organism that is cultivable in agar. The growth therein is infinitely richer than on ordinary agar, but dies much more rapidly.

The author then goes on to describe the procedure by which he obtains large masses of bacteria. The method is essentially the same as the foregoing, and consists in cultivating in Petri capsules containing glycerin-potato-agar, the condensation water being removed by means of blotting-paper.

Collecting and Studying Flustrella hispida.† — R. M. Pace collected the material from places on the South Coast, where it was found abundantly between tidemarks on *Fucus*, and occasionally on other algæ. The colonies form dark mossy-looking patches, encrusting the algal fronds.

For the study of larval development, colonies of one or two seasons' growth taken close to low-water mark proved the most suitable. Such colonies contain abundance of spermatozoa or of ova and larvæ, according to the season. The reproductive period commences early in February and continues till the beginning of August. In pure running water *Flustrella hispida* may be kept alive in tanks for an indefinite period, but usually only for a few days to a week.

The larvæ were examined in the living state and after fixation; the fixatives used were (1) saturated sublimate with 5 p.c. acetic acid; (2) 5 p.c. chromic acid 100 parts, with 5 drops acetic acid; (3) Flemming; (4) Hermann; (5) chromo-nitro-osmic mixture; (6) acetic alcohol with sublimate to saturation; (7) Kleinenberg. After fixation the material was removed to 70 p.c. alcohol. Chrom-acetic acid and corrosive acetic gave the best results for fixation in bulk. Larvæ were isolated by slicing off the front wall of the colony with a razor; the larvæ lie just below this wall, enclosed in the tentacle-sheath. For isolated larvæ the best fixatives were corrosive acetic and acetic alcohol saturated with sublimate.

Entire eggs and larvæ were examined during life and after fixation. The latter were stained with borax-carmin or with safranin. In some cases the nuclear spindles and the yolk-nucleus were clearly brought out.

Sections were made from isolated larvæ and of colonies containing

* Ann. Inst. Pasteur, xx. (1906) pp. 625-64.
† Quart. Journ. Micr. Sci., l. (1906) pp. 435-78 (66 figs.).

larvæ. Groups of 20–30 isolated larvæ were imbedded together, the sections thus obtained being in a variety of planes. In order to determine the direction of unorientated lavæ, a set of standard sections was prepared by carefully orientating single larvæ which had been first studied entire.

To insure thorough impregnation of colonies with larvæ *in situ*, the material was left in xylol for about a week before being passed through xylol-paraffin to paraffin. This material is difficult to imbed and section owing to the presence of chitinous spines, which are sufficiently hard to notch the razor.

The most useful stain for sections was Heidenhain's iron-hæmatoxylin, followed by eosin in 90 p.c. alcohol. Other stains were used, among which was Mayer's mucicarmin for detecting the presence of mucin.

Differentiation of Bacillus typhosus.* — Loeffler advocates the following medium for the differentiation of the *Bacillus typhosus*. 100 c.cm. of distilled water containing 2 p.c. of peptone, and 1 p.c. of nutrose, are neutralised by the addition of 1·06 c.cm. of normal potash; to this is added 5 p.c. of lactose and 1 p.c. of glucose; after boiling and cooling, 3 c.cm. of a 2 p.c. solution of malachite green are added to the mixture. When tubes of this medium are inoculated with *Bacillus typhosus*, a coagulum is formed and a clear green liquid separates out; with other organisms, such as those of the *Coli* group, *Bacillus enteriditis* Gaertner, and paratyphoid bacilli, active fermentation occurs, the precipitated nutrose adhering as dirty green flakes to the wall of the tube, or carried to the surface of the liquid by the gas that is formed. When glucose is omitted from the medium, only the *Coli* group cause a fermentation. Other organisms have a reducing action on the green, turning it a pale yellow colour. Paratyphoid A turns the liquid a pale blue colour.

Ability of Vibrio choleræ asiaticæ to Decompose Starch.†—M. H. Gordon cultivated a series of bacteria in the following medium: Lemco 1 grm., peptone 1 grm., sodium bicarbonate 0·1 grm., starch 0·5 grm., aqua dest. ad 100 c.cm. The medium is tinted with litmus. It has been found that *Vibrio choleræ asiaticæ*, when cultivated in this medium at 37° C., decomposes the starch with a strongly acid reaction within 24 hours, whereas the vibrio of Finkler and Prior produces no such reaction in this time, and only a feeble acid reaction by the third day. Staphylococci, streptococci, *B. diphtheriæ*, *B. coli*, *B. enteriditis* Gaertner, *B. typhosus*, *B. proteus*, all fail to produce an acid reaction in this medium. The rapid positive reaction of cholera, therefore, in this test has a differential value. It may be added that the acid reaction notifying decomposition of the starch is also produced by the cholera vibrio when cultivated in distilled water tinted with litmus, and containing 1 p.c. peptone, 0·5 p.c. salt, and 1 p.c. starch.

Cultivating Wood-Destroying Moulds.‡—B. Malenković finds that the destruction of wood is due to the action of one or more different

* Brit. Med. Journ. (1906) i., Epitome 328. See also Deutsch. Med. Woch., Feb. 22, 1906.
† Brit. Med. Journ., 1906, ii., p. 197.
‡ Centralbl. Bakt., 1te Abt. Orig., xli. (1906) p. 405.

classes of moulds and not to one mould in particular, since the products of the destruction and decomposition of the wood are not always the same, and seem to be brought about by different enzymes. The author refers to the observations of Tubeuf on the mould of "dry rot"—*Merulius lacrymans*—which appears to grow best in a medium containing carbon in the form of pure cellulose, but grows badly with carbon in the form of pine shavings.

Coniophora cerebella is one of the most widely distributed wood-destroying moulds. The author obtained a fresh mycelium from a telegraph post; a fruit-bearing portion was placed on bread pap, and after a few days at 15° C., a mycelium grew, from which, by subculturing, a pure culture was obtained. It grows well on alkaline media; it can obtain its nitrogen from ammonia, but has no denitrifying action on nitrates; on pine or beechwood saw-dust moistened with water, it grows badly, but if moistened with a nutrient mineral salt solution good growth occurs at 15°–17° C. The author finds that the destruction of the wood is greater than that required as nourishment of the mould, since if wood totally destroyed by *Coniophora cerebella* is powdered and moistened with nutrient mineral salt solution, it forms a good medium for the growth of this mould. After the destruction of wood by a mould has proceeded to a certain degree, the destructive process ceases. The author thinks that this is analogous to the alcoholic fermentation of yeast, the products of the metabolism having a hindering effect on the growth of the mould. All the derivatives of dextrose, mannose, and galactose serve as good sources of carbon, but lævulose and arabinose are unsuitable.

Cultivation of Bacillus fusiformis.*—X. Lewkowicz finds that this organism, which is a normal inhabitant of the mouth, and a probable factor in the production of inflammation of the jaw, ulcerative stomatitis, etc., is best grown on glucose agar to which serum has been added, the colonies appearing after 24 hours, in the deep oxygen-free layers of the medium, about 12 to 15 mm. from the surface. The bacillus has a great tendency to polymorphism, and only quite young cultures show the regular round-ended rods in any proportion; spindle and thread forms are very common, the bacilli being often joined in pairs. Quite young cultures stain regularly, but never by Gram's method. The bacillus is non-motile, and does not form spores. Cultures have a characteristic nauseous odour. The microbe is pathogenic for laboratory animals. Introduction into the mouths of healthy children gave negative results.

Voges and Proskauer's Reaction for Certain Bacteria.†—A. Harden, from chemical examinations of the products formed by *Bacillus lactis aerogenes* and other bacteria from glucose medium, finds that Voges and Proskauer's reaction is due to acetylmethylcarbinol. This substance in the presence of potash and air is oxidised to diacetyl which reacts with some constituent of the pepton-water in the medium and gives the characteristic fluorescent colour.

* Centralbl. Bakt., 1te Abt. Orig., xli. (1906) p. 153.
† Proc. Roy. Soc., Series B, lxxvii. (1906) p. 424.

Collecting and Preserving Volvox globator.* — F. St. J. Parker has discovered that *Volvox globator* can not only be kept alive, but also will multiply amazingly for months if vigorous specimens collected from a clean pond be placed in a glass bottle, and the bottle, fully exposed to the light, be laid on the meeting-rail of a window facing west. The bottle should be a clear glass, hand-made, round, wide-mouthed bottle, 5¾ in. high by 1¾ in. in diameter.

Studying the Development of Thelebolus stercoreus.†—G. Ramlow used sterilised dung or dung-agar (dung decoction + 1·8–2 p.c. agar) as cultivation medium. Pure cultures were obtained by inoculating the medium with spores. The growth was fixed with Flemming's fluid, Merkel's platinum-chloride-chromic-acid mixture, Keiser's 2 p.c. sublimate-acetic-acid, and with Hermann's mixture. Weak Flemming gave the most satisfactory results. The osmic acid mixtures blackened the mycelium, but this was obviated by after-treatment with hydrogen peroxide. The best preparations were obtained by fixing for from 2–3 minutes, except in the case of sublimate-acetic-acid, which required 15–20 minutes.

The agar pieces thus fixed were cut up into thin plates, and having been passed through chloroform, were imbedded in paraffin and sectioned.

The preparations were stained with Flemming's safranin-gentian-violet-orange solution, or with Heidenhain's iron-hæmatoxylin. The effect of the latter was increased by contrast-staining with orange G or with light-green (1 : 400 alcohol). The sections were mounted in balsam, and the agar pieces preserved in glycerin.

Cultivation of Gonococcus.‡—E. A. Rothmann, after reviewing the history of the cultivation of *Gonococcus*, remarks that media containing serum, and especially ascites-agar, are by far the most satisfactory for the artificial cultivation of this organism.

(2) Preparing Objects.

Studying Discomycetes.§—J. Lagarde examined the carpophore and hymenium in the fresh condition and also after treatment with a mixture of methylated spirit and formalin (75 parts 5 p.c. formalin and 25 parts alcohol 95°). The hymenium was examined by teasing out and by compression after treating the fragments with potash. Sections made by hand were treated for a long time with eau-de-favelle to get rid of their cell-content. On removal from the eau-de-favelle the sections were washed in water for at least 10 minutes, and then placed in 1 p.c. acetic acid or in 1 p.c. ammonia, according to the nature of the staining solution to be used. The dyes mentioned are anilin-blue, methylen-blue, "bleu Poirrier lactique," vesuvin, ruthenium red, and Congo red; stock 1 p.c. solutions were diluted for use with five to ten times their volume of water.

* English Mechanic, lxxxiii. (1906) p. 461.

† Bot. Zeit., lxiv. (1906) pp. 85–99 (1 pl.).

‡ Russki Vratch., No. 27 (1905). See also Centralbl. Bakt., Ref., xxxviii. (1906) p. 220.

§ Ann. Mycol., iv. (1906) pp. 125–201 (2 pls.).

For the cytology of these fleshy Discomycetes the strong Flemming's solution and Bouin's picroformalin and alcohol (picric acid 1, acetic acid 10, formalin 20, alcohol [70 p.c.] 70) were used, but the latter gave the best results. In this fixative the material was immersed for 24–48 hours, and then, after washing, was passed through up-graded alcohols to xylol or cedar oil preparatory to paraffin. The melting point of the paraffin was 42° and the temperature of the first bath 45°. In the second bath the melting point was 58° and the temperature 62°.

Sections 3–7 μ thick were made with a Minot microtome, and were freed from paraffin by immersing them in a bath of turpentine oil for 24 hours; the latter was got rid of with alcohol, and then the sections were hydrated in down-graded alcohols preparatory to staining.

The stains used were iron-hæmatoxylin, magenta-red, diamond-fuchsin, polychrome-blue.

The magenta-red procedure is as follows: After washing in water the sections are immersed for 10–20 minutes in 1 p.c. magenta-red in anilin water. After washing again they are stained for 3–5 minutes with picro-indigo carmin (0·5 grm. indigo carmin in 100 c.cm. of saturated aqueous picric acid solution). After a short wash in water the sections are differentiated and dehydrated with absolute alcohol, followed by oil of cloves, xylol, balsam.

Influence of Fixation on the Volume of Organs.*—Helene Stoltzner comes to the following conclusions. The fixatives in ordinary use have a greater or less effect on the volume of the organs. This effect varies with the organs; thus picric acid causes shrinkage of the liver, but increases the bulk of kidney, spleen, and brain. Some other and as yet unknown factors than the concentration of the fixative solution play an important part in the change of bulk of the material. In 4·5 p.c. cane sugar solution saturated with sublimate is found an isotonic fixative for warm-blooded animals, which leaves the volume of the organs unchanged.

Studying Spermatogenesis of the Earthworm.†—P. Depdolla, after trying several of the ordinary fixatives, finally adopted Benda's acetic acid chrom-osmic acid mixture. During the first half of the investigation the preparations were stained with iron-hæmatoxylin. The author then tried gentian-violet, and finally settled down to Benda's mitochondria stain, sulphalizarinate of sodium, and crystal-violet with iron mordant.

Studying the Segmentation of Siphostoma floridæ.‡—Eug. W. Gudger obtained male pipe-fishes, opened the pouch, removed some eggs, and examined them under the Microscope. If they were in a stage wanted, the head of the fish was cut off and the eggs removed from the pouch. The best killing fluids were found to be Perenyi's 10 p.c. and 20 p.c. formalin, Gilson's and Worcester's fluids. This last consists of saturated sublimate in 10 p.c. formalin 90 parts, glacial acetic acid

* Zeitschr. wiss. Mikrosk., xxiii. (1906) pp. 14–25.
† Zeitschr. wiss. Zool., lxxxi. (1906) pp. 632–90 (1 pl.).
‡ Proc. U.S. Nat. Mus., xxix. (1906) pp. 447–500 (7 pls.).

10 parts. In this the eggs are left for from 30–60 minutes, and after washing in water are passed through alcohols up to 70 p.c., the excess of sublimate being removed with iodine.

Sometimes the eggs were next placed in 10 p.c. hypochlorite of sodium or potassium to soften the connective tissue and the egg membranes, but generally the shells were removed with needles after the alcohol stage.

The younger blastoderms were picked off the yolk and sectioned, but in later stages the eggs were cut whole, and in order to orient whole eggs in paraffin it is necessary to stain them, and best with borax-carmin. The sections were stained with hæmalum or with iron-hæmatoxylin. The former gave by far the better results.

Studying End-Organs of Rhynchobdellida.* — W. Mayer almost exclusively used *Clepsina sexoculata* in his research, the exceptions being *C. marginata* and *Piscicola geometra*. The material was fixed either in sublimate-acetic acid or in chrom-osmium-acetic acid, and then stained *en masse* with borax-carmin. Sections from these pieces were after-stained with Blochmann's solution. Other sections from material not treated *en masse* were stained with iron-hæmatoxylin, van Gieson, hæmatoxylin and acid fuchsin, and methyl-green. Special methods were also adopted for staining the nerves. For the intra- and supra-vitam methods, methylen-blue ¼ to ⅛ p.c. solutions were used, the injected material being afterwards fixed with molybdenate of ammonium and then imbedded in paraffin. Golgi's rapid method was also used. For this the pieces were immersed for 4 or 5 days in potassium bichromate, then followed by ¾ p.c. silver nitrate, and imbedding in celloidin.

Studying the Vascular Endothelia and Blood of Amphibia.†— Kati Marcinowski fixed the material (embryos of *Bufo* and *Siredon pisciforme*), with a mixture of picric acid and sublimate for from 10–24 hours. After washing in water, the objects were dehydrated in up-graded alcohols and then transferred to cedar oil for preservation or direct imbedding in paraffin. The paraffin used was a mixture of hard superheated ⅓ and an ordinary paraffin ⅔. The imbedding temperature was kept as low as possible. The sections were mostly stained with borax-carmin.

Studying the Histogenesis of Cercariæum helicis.‡—C. F. Roewer fixed the material, kidneys removed from snails, in Rabl's sublimate-platinum-chloride mixture, in hot sublimate or in osmic acid. That fixed with osmic acid was afterwards treated with silver nitrate, while the material fixed in sublimate was stained with borax-carmin (in sections), or with carminate of sodium (in bulk). In the latter case the sections were contrast-stained with indigo-carmin-picric acid, or a mixture of bleu-de-Lyon and ammonium picrate. The formula for the latter is as follows: 25 c.cm. bleu-de-Lyon (1 p.c. in distilled water), 65 c.cm. ammonium picrate (saturated aqueous), 10 c.cm. picric acid (saturated

* Zeitschr. wiss. Zool., lxxxi. (1906) pp. 599–631 (3 pls.).
† Jena Zeitschr. Nat., xli. (1906) pp. 19–112 (5 pls.).
‡ Tom. cit., pp. 185–228 (2 pls.).

aqueous), 75 c.cm. distilled water, 50 c.cm. absolute alcohol. Several other staining methods were tried, among which may be mentioned the vital staining with methylen-blue followed by fixation with ammonium molybdate.

Demonstrating the Lymphatic Vessels of the Prostate.* — R. Caminiti, after recounting the methods of previous investigators, describes the procedure which has given the best results. After tying the ureters and urethra with silk thread, a 0·5–1 p.c. aqueous solution of silver nitrate is injected into the gland by means of a Pravaz syringe. Injections are made in numerous places and in all parts. The gland is then washed in distilled water, and afterwards placed in absolute alcohol, frequently changed, until it is sufficiently hardened. The sections (freehand or paraffin) are exposed for a few minutes to sunlight, and then transferred to a weak alcoholic solution of sodium hyposulphite (0·5–1 p.c.). After repeated washing in absolute alcohol, they are placed in bergamot-oil for some hours, and thence transferred to xylol and balsam. If the sections be over-blackened by the sun, they should be placed in 3–5 p.c. potassium iodide solution in 95 p.c. alcohol. From this they are transferred to 95 p.c. alcohol, and then to sodium hyposulphite.

In some cases Berlin blue was also injected through the aorta or iliac artery before the silver nitrate was used.

Investigating the Structure of Spinal Cord of Macaque Monkey.† Mabel P. Fitzgerald injected this monkey (*Macacus sinicus*) by Mann's method with picro-corrosive-formaldehyde solution. 2·5 grm. of sublimate were dissolved in boiling water, and then 1 grm. of picric acid added. When cold, and just before use, 10 c.cm. of formol were added. The cord was removed after about 24 hours, and then, together with the spinal ganglia, placed in 50 p.c. alcohol. It was next dehydrated in up-graded alcohols, and imbedded in paraffin (m.p. 52°). Serial sections, 20–20 μ thick, were cut, and, having been treated in the usual way to remove the mercury, were stained with eosin and toluidin-blue.

Studying the Structure of Visceral Ganglion of Anodonta.‡— T. Freidenfelt first injected the fresh material with methylen-blue of various strengths, and after a preliminary examination to ascertain if the staining had been successful, fixed in Bethe's fluid. After hardening, the material was imbedded in soft paraffin, and coarse sections made. Good results were obtained by Lavdowsky's method, which consists in mixing fresh egg-albumen with about a similar quantity of 1 p.c. methylen-blue in physiological salt solution. Still better was to take some of the animal's blood and mix with methylen-blue diluted with ammonium chloride. The methylen-blue used was from 0·1–0·5 p.c., and the ammonium chloride about 0·1 p.c.

The author remarks that Bethe's method of after-treatment with potassium bichromate is not, in his opinion, altogether satisfactory.

* Anat. Anzeig., xxix. (1906) pp. 172–85 (4 figs.).
† Proc. Roy. Soc., Series B, lxxviii. (1906) pp. 88–144 (numerous charts and figs.).
‡ Acta Univ. Lundensis, xl. (1904) received Aug. 1906, Afdeln 2, No. 5.

Studying the Epididymis.*—R. Ikeda followed the method recommended by Benda for examining the minute structure of the epididymis of man. (1) Fresh material was fixed for 2 days in 93 p.c. alcohol, to which 10 parts of formalin were added. (2) The material was next hydrated with dilute nitric acid (1 vol. officinal nitric acid to 10 vol. tap-water), 24 hours. (3) 24 hours in 2 p.c. potassium bichromate. (4) 48 hours in 1 p.c. chromic acid. (5) 24 hours washing in water. (6) Hardening in upgraded alcohols. (7) When the pieces are removed from absolute alcohol they should be placed in a mixture of equal parts of absolute alcohol and creosote before being saturated with paraffin.

The sections, which were not more than 5 μ thick, were stained by three different methods.

A. Modified Weigert's Glia-staining: (1) The sections were treated for 5 minutes with 0·5 p.c. potassium permanganate, followed by (2) Pal's reducer, sodium sulphite and oxalic acid, for about 3 minutes. (3) After drying with blotting-paper the section surface was flooded with Weigert's methyl-violet-oxalic-acid solution, or with Benda's crystal-violet-anilin-water mixture (1 vol. crystal-violet in 70 p.c. alcohol, 1 vol. 10 p.c. hydrochloric-acid-alcohol, and 2 vol. anilin-water). (4) Mop again with blotting-paper, and flood with Lugol's solution for about 1 minute. (5) Wash with water, differentiate with anilin-oil-xylol until no more colour is given off. (6) Dry; flood with xylol several times, and mount in balsam.

B. Iron-hæmatoxylin method: (1) The sections are mordanted for 24 hours with 4 p.c. iron-alum solution, or with liq. ferri sulph. oxydat. diluted with 2 vol. distilled water. (2) Washed in running water. (3) Stained for 24 hours in dark-yellow aqueous hæmatoxylin solution, made by dropping strong alcoholic hæmatoxylin solution into water. (4) Washed in tap-water for ½ hour. (5) Differentiated with Weigert's borax-ferricyanide solution, until the sections are yellowish-grey. (6) Washed; dehydrated; mounted in balsam.

C. Alizarin staining: (1) Mordant for 24 hours with 4 p.c. iron-alum solution. (2) Wash in running water. (3) Stain for 24 hours in dilute amber-yellow solution of sulphalizarinate of sodium. (4) Wash, and mop up with blotting-paper. (5) Stain in 0·1 p.c. aqueous solution of toluidin-blue for 24 hours in cold solution, or for 15 minutes if heated to vaporisation. (6) Treat with 1 p.c. acetic acid. (7) Dry with blotting-paper, and flood with absolute alcohol. (8) Differentiate with creosote, examining under low power, until connective-tissue is red and the cell-nuclei blue. (9) Dry with blotting-paper; treat several times with xylol, and then mount in balsam.

Demonstrating the Embryology of Amentiferæ.†—Margaret Benson, Elizabeth Sanday, and Emily Berridge, found that the fertilisation process took place chiefly between July 6 and July 10. The fixatives used were absolute alcohol and Flemming's strong and weak fluids. The ovaries were dissected immediately on gathering, the ovary wall being removed as far as possible so as to expose fully the ovules to the

* Anat. Anzeig., xxix. (1906) pp. 1–14 (1 pl. and 8 figs.).
† Trans. Linn. Soc. Bot., vii. (1906) pp. 37–44 (1 pl.).

action of the fixing agent. The absolute alcohol material was after 2 days transferred to methylated spirit for a week, and then preserved in a mixture of equal parts of absolute alcohol, glycerin, and distilled water. The material fixed in Flemming's fluid was placed after about 2 hours in 5 p.c. chromic acid for 16–18 hours, and then washed in running water for several hours. The material was finally passed through up-graded alcohols into methylated spirit, left there for a week, and afterwards transferred to the same preserving fluid as before. To prepare for sectioning, as much extraneous tissue as possible was removed from the ovules, which were then passed through absolute alcohol, bergamot-oil, to paraffin of various melting-points, being cut finally in 52° m.p. paraffin.

The sections, mostly 16 μ thick, were stained with Flemming's triple stain and Ehrlich's hæmatoxylin. The former was more effective for nuclear fusion, the latter for the pollen-tubes.

Demonstrating Life-history of Leucocytes.*—C. E. Walker fixed the material with Flemming's fluid (strong formula), Hermann's fluid, acetic acid and absolute alcohol, corrosive sublimate and acetic acid, and strong formic acid. The author remarks that the greatest care must be taken with the processes of fixation, dehydration, imbedding, staining, etc. Extremely small pieces of tissue should be placed in the fixative within about a minute of the death of the animal or removal from the living body. Dehydration should be carried out in short stages, an increase of 10 p.c. of alcohol being perhaps best. This does not apply to tissues fixed in acetic acid and alcohol or strong formic acid (40 p.c.), from which the tissues are transferred immediately to absolute alcohol. At the same time, it is necessary that the tissues should not be left in alcohol (under 80 p.c.) for more than two or three hours after fixation. In imbedding, no higher temperature than 45° C. should be used. Throughout the processes of staining and mounting, the greatest care must be taken that the sections do not become even partially dried upon the slides.

It is almost necessary to use a 10-inch tube Microscope with monochromatic light and apochromatic objective and eye-piece. With a monochromatic light it is possible to obtain excellent definition with a 27- or even 40-compensation ocular, and a 2 or 3 mm. apochromatic objective. Anything approaching this is impossible with the ordinary short tube.

In view of the advantage gained by using a monochromatic light, the stains must be chosen with regard to the colour of the light used. The part of the spectrum between the blue and green gives the shortest wave-lengths that can be conveniently used. As this gives a better definition than the parts of the spectrum with longer wave-lengths, red, yellow, and orange stains give the best results.

Studying the Spinal and Sympathetic Ganglion Cells of the Frog.†—E. Warfuringe fixed some of the material with 96 p.c. alcohol and 2 p.c. ammonia, the rest with 40 p.c. alcohol and 2 p.c. ammonia.

* Proc. Roy. Soc., Series B, lxxviii. (1906) pp. 53–9 (4 pls.).
† Archiv Mikrosk. Anat., lxviii. (1906) pp. 432–40 (1 pl.).

This was followed by 1·5 p.c. silver nitrate solution for 6–12 days, with subsequent reduction with hydroquinone. In some cases the reduction was hastened with soda and sodium sulphite. The 40 p.c. spirit preparations retained the colour best, and it was afterwards found advisable to use 3 p.c. silver nitrate, as 1·5 p.c. was not strong enough. The paraffin sections were after stained with thiazin-red.

Moist Chamber for Studying the Thrombocytes of Salamanders' Blood.*—F. Meves, when studying the thrombocytes of salamanders' blood and their relation to coagulation, used the following apparatus (fig. 72). The moist chamber, made of tin, was 14 cm. long, 7½ cm. broad, and 5½ cm. high, and to one of the two long sides was soldered a thick metal plate. Halfway up, this side was traversed by a slit 8½ cm.

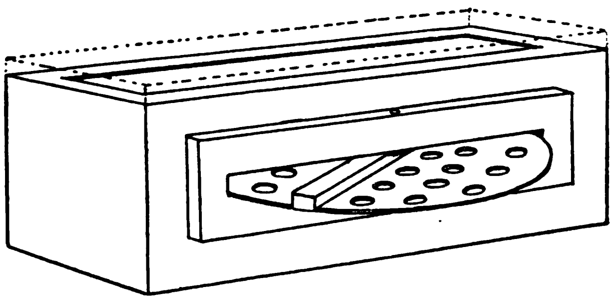

Fig. 72.

long and about 4 mm. thick. Into this slit fits a metal piece which carries a circular tray. The metal piece and the disk were able to revolve round a vertical axis passing through their centre. The chamber, which is open at the top, was filled to a depth of 1 cm. with 0·8 p.c. salt solution, and then covered with a glass plate made air-tight by means of vaselin. The slides, covered with a fresh film of blood, were placed on the outer half of the tray, and then, by giving it a turn through 180°, were quickly brought into the moist atmosphere.

As fixatives, 1 p.c. sublimate or Flemming's mixture (weak formula), both with 1 p.c. salt added, were employed. The sublimate-fixed preparations were stained with the Ehrlich-Biondi solution, while Flemming preparations were treated with safranin and Delafield's hæmatoxylin, or with Flemming's triple stain.

Studying Polysiphonia violacea.† — S. Yamanouchi fixed his material in Flemming's fluid, Hermann's fluid, and 1 p.c. picric acid. He found that chrom-acetic acid (1 p.c. chromic acid, 25 c.cm.; 1 p.c. glacial acetic acid, 10 c.cm.; sea-water, 65 c.cm.) was best suited for

* Archiv. Mikrosk. Anat., lxviii. (1906) pp. 311–58 (4 pls.).
† Bot. Gazette, xli. (1906) pp. 425–33.

study of spermatogenesis and the germination of carpospores and tetraspores. The material was left in the fixative for 5–40 minutes, and then washed in sea-water, after which it was passed through up-graded alcohols to 52° m.p. paraffin. The sections were stained with safranin-gentian-violet or with iron-hæmatoxylin, and these were sometimes followed by orange G, Bordeaux red, or Congo red.

Studying the Nutritive Relations of the Surrounding Tissues to the Archegonia in Gymnosperms.*—M. C. Stopes and K. Fujii found that the best fixative was 90 p.c. alcohol, and that Flemming's fluid was less satisfactory owing to the presence of some substance which reduced the osmium.

Sections were stained with Flemming's triple stain, acetic-methyl-green, Congo red, and various iodine solutions.

Studying the Larvæ of Bryozoa.†—O. Seeliger preserved the larvæ and embryos in sublimate, sublimate-acetic-acid, formalin, and osmic acid. *Pedicellina* larvæ treated with sublimate or formalin made excellent preparations after staining and clearing up in oil and balsam or in glycerin. *Alcyonidium* larvæ never cleared up sufficiently. Most of the staining was done with carmin and hæmatoxylin, but orange was used as an after-stain for yolk-masses. Larvæ which had been fixed in formalin were stained with molybdic-acid-hæmatoxylin or with phospho-molybdic-acid-hæmatoxylin. The shape of the individual elements of a section was more clearly brought out by tapping on the cover-glass so as to dissociate the cells, though this procedure was only partially successful.

Studying the Germ-Cells of Enteroxenos östergreni.‡—Kristine Bonnevie at first fixed this Holothurian parasite in sublimate-acetic-acid, picric-acid-sublimate, or in picro-acetic-acid, but found that Zenker's, Hermann's, and Flemming's fluids were more satisfactory. For the ovary Zenker's fluid gave the best results, while Hermann's was superior for the testicles, but was allowed to act for only 4 hours. The principal stain used was Heidenhain's iron-alum-hæmatoxylin, though special methods were adopted for nucleoli and mitochondria.

Demonstrating Spirochæta pallida in Bone.§ — E. Bertarelli describes three cases of syphilitic osteochondritis in various aged fœtuses. The tissues were fixed in formalin or alcohol and imbedded in celloidin —the bones being decalcified in 1·5 p.c. nitric acid—and were impregnated by an acid alcoholic solution of silver nitrate. In one case, in sections of the femur of a seven-months fœtus, many spirochætes were observed in the periosteum and in the layer of spreading ossification, but were not regularly distributed; endocellular forms were not seen, all the spirochætes lying between the connective-tissue bundles; some were very long, some with pointed ends, others showed a distinct bead at one or both ends.

In another case, from the femur of an eight-months fœtus, though

* Beih. Bot. Centralbl., xx. (1906) p. 1–24 (1 pl.).
† Zeitschr. wiss. Zool., lxxxiv. (1906) pp. 1–78 (4 pls.).
‡ Jena Zeitschr. Naturw., xli. (1906) pp. 229–420 (8 pls.).
§ Centralbl. Bakt., 1te Abt. Orig., xli. (1906) p. 639.

there was marked osteochondritis, the spirochætes were not so numerous, but in the marrow were seen many badly stained and fragmented forms. In a third case, from a portion of a long bone, of probably a full-term fœtus, very few spirochætes were observed, and these were badly stained.

Studying the Development of Nebalia.* — Margaret Robinson fixed the eggs, removed from the pouches, in hot saturated sublimate solution, to which a little acetic acid had been added. After washing they were passed slowly through up-graded alcohols to 80 p.c. alcohol.

The shells of the early stages were removed by teasing with fine needles.

To obviate difficulties arising from the brittleness of the yolk, the material was either imbedded in celloidin, or each section was painted with a mixture of equal parts of gum mastic and celloidin. In the former case the material was orientated by cutting the celloidin to the required shape, and in the second by fastening the embryo in position on a piece of lardaceous liver before imbedding in paraffin. Sections 4 μ thick were stained with Kleinenberg's hæmatoxylin and orange.

Demonstrating the Structure of Erythrocytes of Siredon pisciformis.†—A. E. von Smirnow, in a research on the structure of the erythrocytes of *Siredon pisciformis*, followed the technique devised by Kopsch when investigating the protoplasmic reticulum in nerve-cells.‡ This method consists in submitting the material to the prolonged action of osmic acid. The author used various strengths of osmic acid, 0·5–2 p.c., in aqueous or in isotonic salt solution. The treatment lasted from ¾ day to 10 days, or longer.

Donaggio's Method of Staining Degenerated Nerve-Fibres.§—A. Veneziani employed Donaggio's methods for demonstrating the degeneration of nervous tissue in the tentacles of *Helix pomatia*. Three varieties are described. The fixatives used were Müller's fluid and sublimate.

A. 1. Sections 20–30 μ were transferred from the fixative to alcohol, and thence for a few minutes to water. 2. They were then stained with a hæmatoxylin-chloride of tin solution (aqueous solution of chloride of tin, 20 p.c.; aqueous solution of hæmatoxylin, 1 p.c.; equal parts of the two solutions are mixed and kept in a cool dark place) for 10–20 minutes. 3. Decolorised in permanganate of potassium 0·25 p.c., and then in an aqueous solution of 1 p.c. oxalic acid, mixed with an equal quantity of 1 p.c. aqueous sulphite of soda. 4. Wash for a few minutes in water. 5. Alcohol; xylol; balsam.

B. 1. Sections 20–30 μ are placed in aqueous 0·5–1 p.c. hæmatoxylin for 10–20 minutes. 2. Saturated aqueous solution of neutral acetate of copper 30 minutes, once renewed. 3. Decolorising, etc., as in A.

C. 1. The material was transferred from the fixative to 70 p.c. alcohol for 3 hours, and for a similar time to absolute alcohol. 2. Imbedding in celloidin. 3. Sections 30–40 μ were placed for 20 minutes

* Quart. Journ. Micr. Sci., l. (1906) pp. 383–433 (6 pls.).
† Anat. Anzeig., xxix. (1906) pp. 236–41 (5 figs.).
‡ See this Journal, 1902, p. 717.
§ Anat. Anzeig., xxix. (1906) pp. 241–8.

in 1 p.c. hæmatoxylin. 4. Decolorising in 15 p.c. aqueous solution of perchloride of iron for a few minutes. 5. Rapid washing in hydrochloric-acid-alcohol (0·75 HCl to 100 C_2H_6O). 6. Absolute alcohol, and removal of celloïdin if necessary. 7. Clearing in xylol or cedarwood oil, as the case may be.

(3) Cutting, including Imbedding and Microtomes.

Aceton-Paraffin Imbedding Method.*—A. E. Sitsen has tested this method, and finds that for diagnostic purposes it is of value, but for demonstrating the finer details there should be a preliminary fixation. Pieces 1–2 mm. thick are placed for 15–30 minutes in 10 p.c. formalin and then for 30 minutes in aceton. After this they are placed in paraffin for an equal length of time.

Material fixed in chromic acid salts requires to be soaked in water for 24 hours. The method is also available for alcohol-fixed tissues. For demonstrating glycogen the material should not be fixed before it is immersed in aceton; fat requires to be blackened by osmic acid, as it disappears if not previously fixed.

Rapid Method of Preparing Large Numbers of Sections.†—G. C. Huber, after alluding to the difficulties attending the preparation of sections for large classes, describes the procedure adopted by him, which is a combination of the warm water method of flattening paraffin sections and the Obregia-Gulland method.

The fixed and dehydrated tissues are impregnated with paraffin in partial vacuum. Serial sections are then made and flattened out in warm water contained in a tray specially devised for the purpose. While still in the water, or in a sugar-dextrin solution, the ribands are floated on to glass plates. On removal, the plates, covered with series of sections, are drained and dried. The paraffin is then removed in the usual way (heat and xylol), after which the plates are transferred to absolute alcohol. The next step is to cover the sections with the following solution: photoxylin 10, absolute alcohol 100, ether 500. When the photoxylin is set the film of sections is removed by immersing it in water. It may then be cut up into any desired lengths, and stained and mounted in the usual way.

If, however, the sections are required for future use, they may be removed by placing the plate in water, and then rolling the film round a glass rod, and afterwards storing the rolls in 80 p.c. alcohol.

For the minute details of the procedure, which are very clearly given, the original should be consulted.

(4) Staining and Injecting.

Staining Piroplasma Muris.‡—H. B. Fantham stained films of the blood and smears from the internal organs of the white rat by various modifications of the Romanowsky method, especially a combination of the methods of Laveran and Plimmer, using Bleu Borrel, erythrosin, and

* Centralbl. Allgem. Pathol. u. Pathol. Anat., xvi. (1905) pp. 774-5.
† Zeitschr. wiss. Mikrosk., xxiii. (1906) pp. 187-96 (2 figs.).
‡ Quart. Journ. Micr. Sci., l. (1906) pp. 493-516 (1 pl.).

tannin-orange. Good results were also obtained with Leishman's stain and with a modification of Giemsa's solution, using a 1 p.c. aqueous solution of azur ii. and 0·1 p.c. aqueous solution of erythrosin mixed on the slide after fixation with pure methyl-alcohol.

Other blood films and smears of organs were fixed with a mixture of sublimate 2 parts and absolute alcohol 1 part, or with osmic acid, and then stained with a dilute acidulated solution of Delafield's hæmatoxylin followed by eosin. The staining is slow, at least 24 hours being necessary.

Demonstrating Segmentary Organs of Polychæte Annelids.*—L. Fage attained the best results, in his researches on the Polychæte Annelids, by means of fine dissection under the Microscope. In order to facilitate the operation, the cœlom was injected with indian ink or carmin, or by treating the specimen from which the digestive tube had been removed with a very dilute solution of neutral-red in sea-water.

Control observations were made from sections of material fixed with a saturated solution of sublimate in sea-water, to which 5–10 p.c. acetic acid were added. Bouin's and Tellyesnicky's fluids gave equally good results. For special purposes, Lindsay's, Flemming's, and Merkel's fluids were used. Paraffin sections were made in the usual way, and stuck to the slide with a $\frac{1}{500}$ gelatin solution in water. The stains used were alum-carmin, iron-hæmatoxylin, and, after osmic acid fixatives, magenta-red or safranin. As plasma stains, light green and orange G were used.

Special methods were adopted to bring out the reticulum of the phagocytic organs and the secretory vesicles. For the former the pieces were macerated in a weak solution of bichromate of potassium, or in Merkel's fluid.

A selective staining of the secretory vesicles was obtained by treating the sections after the manner of Weigert.

Demonstrating Chromatic or Nucleoid Granules.†—N. Loewenthal fixes the material in Flemming's solution, and stains the sections with paraffin, afterwards decolorising with alcohol acidulated with hydrochloric acid.

Zenker's fluid followed by hæmatoxylin and eosin was also used, except for the cerebro-spinal ganglia, which were fixed either in chromosmic-acetic acid or in Erlicki's fluid; staining in the former instance being effected with safranin, in the latter with picro-carmin or hæmatoxylin.

Part played by Sodium Chloride in the Silver Impregnation Method.‡—Ch. Achard and M. Agnaud support the view recently put forward by Quinton that the reduction of the silver in the tissues is due to the presence of sodium chloride in the intercellular spaces, and the formation of a precipitate of silver chloride, which turns black on exposure to the light. The authors find that if the sodium chloride be removed by immersing the membrane in a solution of sodium sul-

* Ann. Sci. Nat. Zool., iii. (1906) pp. 261–410 (2 pls.).
† Journ. Anat. et Physiol., xlii. (1906) pp. 305–56 (1 pl.).
‡ Comptes Rendus, cxlii. (1906) pp. 1571–2.

phate or of sugar, it is no longer possible to impregnate the tissue; and, per contra, if such a dechlorided membrane be treated with physiological salt solution, the tissue is then as effectively impregnated as is fresh membrane. These facts explain why nervous and other tissues often fail to become impregnated—they have been accidentally dechlorided.

Physiological Injection for Studying Development of Enamel.* H. Ganzer studied the histogenesis of enamel by means of injections of saturated solutions of sulphindigotate of soda. Results of several experiments are given in tabular form, the most satisfactory being: subcutaneous injection of 4 c.cm. for two successive days followed after an interval of a day by injection of a similar quantity into the peritoneal sac. The animal was killed after the lapse of three-quarters of an hour, and it was found that the non-calcified parts of the teeth were stained deep blue. The other result was obtained by injecting 4 c.cm. into the peritoneal sac, and killing the animal three-quarters of an hour after. In this case the non-calcified parts were of a sky-blue hue.

Demonstrating Nerves in Female Genital Tract.†—F. Worthmann studied the nerves and nerve-endings of the clitoris and vagina by the methylen-blue method. Pieces of quite fresh tissue were sectioned between slips of elder-pith. The sections, placed on a slide, were treated with $\frac{1}{30}$ p.c. methylen-blue in physiological salt solution and incubated for about 10 minutes at 35°. If, when placed between two slides, they showed, on inspection under the Microscope, a good staining of the coarser nerves, they were transferred to 7·5 p.c. aqueous solution of molybdenate of ammonia for 6–8 hours. If not properly stained, they were replaced in the methylen-blue solution for 5–10 minutes, and then if nothing were to be seen, they were rejected.

On removal from the molybdenate solution the sections were washed in frequently changed distilled water for 2–4 hours. Some sections were then very rapidly dehydrated in absolute alcohol, and, after xylol, mounted in balsam. Other sections were, on removal from water, cleared in glycerin, and then mounted in glycerin jelly (Beale's formula).

Demonstrating the Regeneration of Peripheral Nerves.‡ — P. Krassin demonstrated the centrifugal course of regeneration of peripheral nerves after division by intra-vascular injection of 1 p.c. methylen-blue in physiological salt solution, or by immersing the preparations for a period in weaker solutions ($\frac{1}{10}$–$\frac{1}{16}$ p.c.) of the same pigment. The staining was fixed either by means of a saturated aqueous solution of ammonium picrate, or by a 5–10 p.c. aqueous solution of molybdenate of ammonium.

Simple Method of Staining Spores.§—O. Ország mixes up the bacteria in a drop of fluid composed of ½ p.c. sodium salicylate 4 parts,

* Anat. Anzeig., xxviii. (1906) pp. 436–42.
† Arch. Mikrosk. Anat. u. Entwikl., lxviii. (1906) pp.122–36 (2 pls.).
‡ Anat. Anzeig., xxviii. (1906) pp. 449–53.
§ Centralbl. Bakt. Orig., xli. (1906) pp. 397–400.

and 5 p.c. acetic acid 1 part, on a clean cover-glass. The size of the drop must be small so that the film dries quickly, after which it is fixed in the flame. The film is then stained hot with carbol-fuchsin, after which it is decolorised with 1 p.c. H_2SO_4 until the preparation is of a pale rose colour.

After thoroughly washing with water, the film is stained with 1 p.c. aqueous methylen-blue, or malachite green, for 2 minutes. The washed and dried film is mounted in balsam. A variation of the method may be made by contrast-staining and decolorising at the same time with a saturated solution of methylen-blue in 1 p.c. sulphuric acid.

Demonstrating Negri's Corpuscles.*—Bohne removed from the cornu ammonis pieces ½–¾ mm. thick and placed them in pure aceton at 37° for 30–45 minutes, or longer if the brain were much decomposed, until they were firm. The pieces were then immersed in liquid paraffin (m.p. 55°) and kept therein at 60° for 60–75 minutes. The sections were removed to cold water to which some gum arabic had been added, and when placed on the slide were dried at 60°. After getting rid of the paraffin the sections were stained for ½–4 minutes by Mann's method (35 c.cm. 1 p.c. aqueous methylen-blue solution + 35 c.cm. 1 p.c. eosin solution + 100 c.cm. distilled water). After washing in water and then in water and alcohol the sections were treated for 15–20 seconds with 30 c.cm. absolute alcohol + 5 drops of 1 p.c. caustic soda solution. The sections were then washed in absolute alcohol followed by tap-water (1 min.) and then by water slightly acidulated with acetic acid, after which they were rapidly dehydrated and mounted in balsam.

The author regards the presence of Negri's bodies as diagnostic of rabies, but expresses doubt as to their parasitic nature.

Demonstrating the Striated Membrane in the Erythrocyte of Salamander.†—F. Meves deposited thin films in a moist chamber for various times (a few minutes to half-an-hour) and then fixed them with weak Flemming's solution (1 p.c. chromic acid 25 c.cm., 1 p.c. osmic acid 10 c.cm., 1 p.c. acetic acid 10 c.cm., distilled water 55 c.cm.) to which 1 p.c. salt was added. After washing in running water the preparations were stained with safranin and Delafield's hæmatoxylin, or with Flemming's triple stain (safranin-gentian-orange). In the former case the films were treated for 24 hours with 1 p.c. aqueous solution of safranin followed by neutral alcohol, and finally by the hæmatoxylin for 6–12 hours. In the latter case the films were treated according to Flemming's directions, though the author differentiated for half-an-hour with oil of cloves previous to mounting in balsam.

Staining of Treponema pallidum Schaudinn.‡—B. Galli-Valerio recommends Giemsa's solution as supplied by Grubler. He uses solutions of 1 : 10 and 1 : 20 acting from 5–20 hours. The *Treponema* is coloured red, the bacteria and spirilla becoming deep violet.

* Zeitschr. f. Hygiene u. Infekt., lii (1905) p. 87 (1 pl.). See also Centralbl. Bakt. Ref., xxxviii. (1906) pp. 220–1.
† Anat. Anzeig., xxviii. (1906) pp. 444–7 (2 figs.).
‡ Centralbl. Bakt., 1te Abt. Orig., xli. (1906) p. 745.

Apparatus for Staining simultaneously numerous Microscopical Sections.*—N. P. Tischutkin describes with a wealth of detail an apparatus which he has devised for the simultaneous treatment of numerous microscopical sections, and of fine histological objects such as embryos, ova, etc.

The apparatus (fig. 73) consists of a couple of tubes, both having wide lips at their upper ends. The outer tube E has a circular aperture O in its bottom, the diameter of the aperture being less than that of the tube J. Between the lower end of J and the bottom of E is interposed a circular piece of mica. Around the neck of the inner tube J is a caoutchouc ring, which fits tightly and accurately into the outer tube E. The sections are placed in the inner tube, and the whole apparatus is immersed in the desired fluid. The fluid then finds its way into the inner tube, and never rises in the outer tube above 0·5–1 cm. The fluid can be removed by tilting up the mica disk with a needle. The apparatus is stated to have given satisfaction.

FIG. 73.

Ruthenium-red as Test for Pectin.†—F. Tobler, after alluding to the properties of ammoniacal ruthenium sesqui-chloride as as a staining reagent for pectic substances,‡ acknowledges its value in that capacity, but shows that as a microchemical test for pectin, its virtues have been over-rated, inasmuch as it is capable of dyeing other substances than pectin and its derivatives.

New Method of Staining Diphtheria Bacilli.§—P. Gălesescu finds that films of *B. diphtheriæ* can be easily stained so as to give a positive reaction in at least 80 p.c. of cases by the following method. Films from blood-serum cultures are stained for 1 minute with 1 p.c. gentian-violet solution, and then, after washing in water, are treated for 1 minute with an aqueous solution of Bismarck brown (0·2 p.c.).

Staining Blood and Bacteria with Eosin-Methylen-Blue.‖—O. Spiegel recommends the solution suggested by May and Grünwald for staining blood-films. He finds that the solution also answers well for bacteria of all sorts. It is made by mixing 1 litre of 1 per thousand

* Zeitschr. wiss. Mikrosk., xxiii. (1906) pp. 45–58 (1 fig.).
† Tom. cit., pp. 182–6.
‡ See this Journal, 1893, p. 563.
§ Zeitschr. wiss. Mikrosk., xxiii. (1906) pp. 67–9.
‖ Centralbl. Bakt., 1te Abt. Orig., xl. (1906) pp. 430–1.

eosin and 1 litre of 1 per thousand medicinal methylen-blue. The precipitate is carefully filtered and washed with distilled water, and then dissolved in 0·25 p.c. methyl-alcohol. The dried but unfixed films are stained for 2 minutes and then treated with distilled water for 1 minute, after which they are mopped up with blotting paper. The distilled water should be perfectly neutral.

A. Huisman * praises Jenner's stain, as it gives more reliable and satisfactory results than other methods. He has devised the following modification. He mixes equal parts 0·175 p.c. solution of solid azur-blue in absolute methyl-alcohol, and 0·825 p.c. solution of eosin B. A. Höchst in the same medium.

The mode of using the stain is the same as in the original method.

Staining Spirochæta pallida.†—F. R. M. Berger finds Dahlia a useful reagent for staining *Spirochæta pallida* (*Treponema pallidum*). He dilutes 4 c.cm. saturated alcoholic Dahlia solution with 20 c.cm. distilled water.

Very thin films are fixed for 5–10 minutes in absolute alcohol and then dried. The films are then treated with a few drops of Giemsa's azur ii. solution for a minute. After washing in water they are dried and passed through the flame. The films are next treated with a few drops of the above described Dahlia solution for 2–3 minutes. After this they are washed in tap-water, dried, rapidly passed through the flame, and mounted in balsam. Instead of Dahlia, gentian-violet may be used; in this case the staining is somewhat darker.

BALAZSY, D.—**Zur Glimmertechnik.**
[Gives a modification of Heidenhain's method of treating sections for class purposes. See this Journal, *ante*, p. 110.
Zeitschr. wiss. Mikrosk., xxiii. (1906) pp. 12–14.

PROWAZEK, S.—**Technik der Spirochäte-Untersuchung.**
[A resume of the various methods employed for demonstrating the structure of *Treponema pallidum*.] *Tom. cit.*, pp. 1–12.

(6) Miscellaneous.

Modification of Schultze's Clearing Method.‡—E. C. Hill, after describing Schultze's, Van Wijhe's, and Lundvall's methods for clearing embryos and other anatomical specimens, details the procedure adopted in the Johns Hopkins Anatomical Laboratory.

The specimens are first injected with Indian ink diluted to one-third its commercial strength. The addition of a small amount of weak ammonia obviates precipitation of the medium. The injection of small embryos should be carried out in warm water, with the membranes still intact. All unnecessary tissue should then be removed.

The specimens are next placed in 95 p.c. alcohol until completely shrivelled (3–7 days). They are then removed to 1 p.c. KHO until transparent (4–48 hours). After this they are placed in 20 p.c. glycerin

* Méd. et Hygiene, No. 4 (1906). See also Brit. Med. Journ. (1906) ii. Epit. 48.
† München. Med. Wochenschr., 1906, p. 1209. See also Zeitschr. wiss. Mikrosk. xxiii. (1906) pp. 224–5.
‡ Bull. Johns Hopkins Hosp., xvii. (1906) pp. 111–15.

for 48 hours more. If cleared, they are immersed in upgraded glycerins. If not clear, they are placed in a mixture of equal parts of 1 p.c. KHO and 50 p.c. ammonium hydroxide for 5–72 hours. Next they come into 20 p.c. glycerin for 48 hours or more, the treatment, as outlined above, being continued.

By following this method, the systems of bones, cartilages, arteries, veins, lymphatics, and various ducts, can be demonstrated in a transparent embryo, or in large sections of adult tissue, without distortion of the structures.

For staining the skeletal system, it is advised to place the fresh specimen in 95 p.c. alcohol, and then treat for 24 hours with alum cochineal, and then clear with 1 p.c. potassium hydrate.

Specimens may be mounted in the following way: Remove from pure glycerin, wipe, and quickly wash. Place in a little thick gelatin, and lay on a warm slide. When the gelatin has hardened, return to pure glycerin.

Microscopic Estimate of Bacteria in Milk.*—F. H. Slack advocates the following method for the bacterial estimate of milk. The sample is centrifuged, and the sediment of a known quantity of milk obtained is emulsified with a drop or two of sterilised water and spread into even smears on glass slides, previously correctly spaced with a blue pencil. The observer finds a representative field seen through a $\frac{1}{12}$th oil immersion, and regards it as a $\frac{1}{10000}$th dilution plate, each coccus, bacillus, etc., representing a colony on such a plate. The number of organisms in the field multiplied by 10,000 gives approximately the number of bacteria per c.cm. in the sample of the milk. The author claims that the method is practical for certifying milk as containing less than 50,000 bacteria per c.cm.; there is also advantage in the rapidity of the method, and in the possibility of examining large numbers of samples without delay.

Counting Bacilli.†—W. C. Oram writes that he has found an instrument, made for him by Alexander and Fowler, of Liverpool, very convenient in the operation of counting the bacilli engulfed by the white blood corpuscles when engaged in estimating opsonic indices by Wright's method. The apparatus consists of two dials—one for recording the bacilli and the other the corpuscles—the dial hand moving through one division of the dial for each depression of the attached pedal. The instrument is intended to be placed upon the floor and worked by the feet, thus leaving both hands free, the one for focusing, and the other for the manipulation of the slide. When the corpuscle register reaches 50, which is the usual number to observe, a bell sounds, indicating the completion of the count, and it only remains to take the reading of the other dial, which will give the number of bacilli found. The instrument, he thinks, might also serve for the taking of ordinary blood counts, one dial being used to register the squares of the hæmocytometer, and the other the corpuscles.

* Technology Quarterly, xix. (1906) p. 37.
† Brit. Med. Journ., 1906, i., p. 1534.

New Form of "Container" for Use in Museums of Economic Botany.*—G. L. Goodall gives the following details: "The materials are—1. Lantern-slide glass of best quality and of standard size. 2. Strips of hard wood of different widths, ranging from $\frac{1}{16}$ in. to 1 in., but of perfectly uniform thickness, namely $\frac{1}{16}$ in. for the widths below $\frac{1}{2}$ in., and $\frac{1}{8}$ in. for the widths above this. 3. Strong fish-glue in a liquid form—that which comes in Dennison's tubes has proved satisfactory. 4. A strong solution of potassium dichromate or a 20 p.c. solution of formalin. 5. Hard paraffin. 6. Strong binding strips well made with good glue.

"From three strips of the wood neatly fastened between two thoroughly cleaned glass slides, one procures a container of the desired thickness. This is filled with the specimen of seeds or other objects and then is closed by placing the fourth strip in position. All four edges are next dipped for an instant in the solution of potassium dichromate or of formalin, in order to render the glue, after drying and exposure to the sun, wholly unaffected by moisture. If preferred, these solutions may be put on with a brush. When the filled container is completely dry, the edges are placed in a thin layer of melted hard paraffin and quickly removed. On cooling, the excess of paraffin is carefully scraped off, and the binding strips are then applied. The prepared container is now ready for installation in any exhibition case. Its contents are proof against invasion by moisture or any museum pests. In the very few instances where insects have been subsequently detected in the container, a small hole was made in one side of the wood, and a little carbon disulphide or chloroform thrown in by a medicine-dropper, and then the hole was closed by a bit of soft wax. In no case has it been found necessary to repeat the dose.

"When the specimen is a powder which it is desired to show in a thin layer, it has been found well to proceed in a different manner. First, a flat cell is made by cementing with glue the thinnest strips of wood on all four sides, and then drying the whole. Into this cell the powder can be put in a perfectly even layer, and then covered carefully by the other slide.

"Among the advantages which this easy method possesses are the following: economy of material, absence of distorting refractions of the container, a convenient tablet form for any exhibition-case, and a free space for labelling. To these advantages may be added the slighter but not unimportant ones: exposure of both sides of the specimen, and security against damage when used as a hand-specimen for class-work."

New Method for Detecting Starch in Wheat Flour.†—G. Gastine has devised a sensitive and certain method for detecting the adulteration of wheat and other flours with rice. It consists of impregnating the suspected flour with a staining solution, drying the preparation slowly, and then heating it for a few minutes at a temperature of 110°–130°, after which it is examined under the Microscope in cedar oil or in balsam.

* Amer. Journ. Sci., xxi. (1906) pp. 451–2.
† Comptes Rendus, cxlii. (1906) pp. 1207–10.

Various pigments are enumerated, greens and blues (0·05 p.c. in 33 p.c. alcohol) being the most suitable. The actual stain, however, appears to be less important than the rest of the technique. By this method rice starch-grains are distinguished from those of wheat by the distinct, relatively large and reddish hilum.

Simple Formula for Mixing any Grade of Alcohol Required.*—E. W. Berger gives the following: Let P represent the grade per cent. of the alcohol on hand, P′ the grade per cent. required, v the number of volumes of water to be added to one volume of P to make alcohol P′, and x the number of volumes of P we desire to change to P′. Then

$$\frac{\mathrm{P}x}{x + vx} = \mathrm{P}'$$

From this we get

$$\mathrm{P}'v = \mathrm{P} - \mathrm{P}'$$

and

$$v = \frac{\mathrm{P} - \mathrm{P}'}{\mathrm{P}'}$$

Microscopic Slides in Drawers.†—R. Inwards writes: In taking slides from the drawers in which they are kept, there is often some difficulty in getting the finger under the edge of the slide so as to lift it

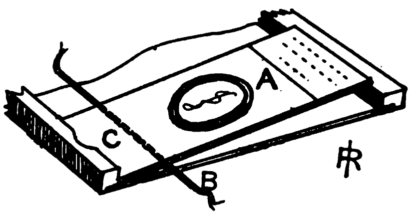

Fig. 74.

out. This is especially the case when the slide nearly fits its recess. The sketch (fig. 74) shows the plan I have adopted. A is the slide in its drawer; B is a piece of silk cord $\frac{1}{16}$ in. in diameter, fastened with seccotin to the bottom of the drawer inside and at $\frac{3}{8}$ in. distant from the front. A slight pressure at C raises up the other end of the slide, which can then easily be taken out. The sketch shows the slide tilted up ready for removal. At other times it lies nearly flat in the bottom of the drawer.

Apparatus for Rapidly Cleansing Sand and Gravel.‡—W. Lorch has devised an apparatus (fig. 75) for cleansing sand and gravel, material so often required in botanical researches. It consists of a

* Ohio Naturalist, vi. (1906) pp. 352–3.
† English Mechanic, lxxxiv. (1906) p. 18 (1 fig.).
‡ Flora, xcvi. (1906) pp. 525–6 (2 figs.).

strong zinc cylinder A, having funnels B, C, at the lower and upper ends. To the top of the cylinder is soldered a circular vessel E, with overflow pipe F. The lower funnel is fitted with a gas-tap D, and the whole apparatus rests by means of three legs on the top of a wooden box. Inside the box are fillets for the support of shelves, and in the top of the box is a large circular hole. The vessel having been filled with sand, the water-tube is connected with the gas-tap, and when the latter

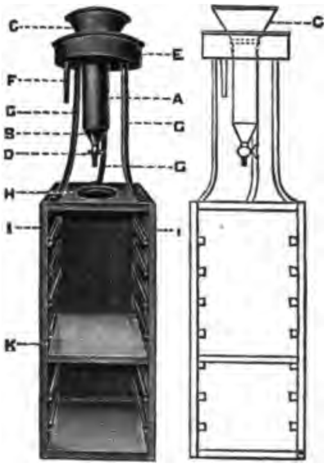

FIG. 75.

is turned the water bubbles up through the zinc vessel. When the sand is clean the water-tube is disconnected, and the clean sand drops through the hole into a suitable vessel placed on the shelf of the box.

New Method of obtaining Hæmin Crystals.*—Sarda and Caffart refer to the method of A. Lecha-Marzo for detecting blood. This method consists in treating the spots with a solution of iodin, pyridin, and ammonium sulphide. The authors modify the foregoing by substituting chlorin and bromin for iodin, and give the following procedure. Place on a slide a drop of blood solution, and evaporate slowly at a moderate temperature. Add successively a drop of chlorin-water, a drop of pyridin, and a drop of sulphide of ammonium, and then put on a cover-glass. With a magnification of 500, crowds of crystals of chlorohæmatin will be seen. The size is variable, the shape is rhomboidal, and the colour red or brownish-red. Exposed to the action of air the crystals do not keep long; the preparations should therefore be ringed round with balsam.

The authors explain the production of the crystals by supposing that the oxy-hæmoglobin is first changed into alkaline hæmatin, then into

* Comptes Rendus, cxliii. (1906) pp. 251–2.

reduced hæmatin or hæmochromogen, which by the action of the chlorin-water becomes chlorohæmatin.

Ammonium sulphide in excess was found to favour the production of hæmochromogen crystals.

BOUVIER, E. L.—**Récolte et conservation des Diptères particulièrement des espèces qui piquent pour sucer le sang.**

[Gives a lucid account of how to collect, mount, and preserve biting and blood-sucking Diptera.]

GARNER, J. B., & W. E. KING—**Germicidal Action of Potassium Permanganate.**

[Experiments showing that this reagent is antiseptic and germicidal in less quantities than those given by Miguel and Jäger.]

Amer. Chem. Journ., xxxv. (1906) pp. 144–7.

Metallography, etc.

Special Brasses.*—This valuable contribution to the study of alloys of copper, zinc, and a third element, by L. Guillet, is a continuation of his previous work on brasses.† When the third element is introduced it first enters into solution in one or more of the constituents of the copper-zinc alloy. At a certain percentage of the added element saturation is reached and a special constituent is formed. Below this saturation point the third element may be considered as equivalent to so much zinc, the alloy formed having properties nearly the same as an alloy of a definite percentage of zinc with copper. The composition of the copper-zinc alloy to which any given ternary alloy is considered to be equivalent, can be determined by microscopic examination. From observations of this kind on alloys containing different amounts of the third element the coefficient of equivalence can be calculated. This is the percentage of zinc to which 1 p.c. of the added element is equivalent. As an instance, take an alloy, Cu 70 ; Zn 28 ; Al 2. The coefficient of equivalence of aluminium is 6. The alloy therefore may be considered as Cu 70 ; Zn 28 + 12. Reducing this to percentage composition, it becomes Cu 63·63 ; Zn 36·37. The properties of a ternary alloy are not identical with those of its equivalent copper-zinc alloy.

The author has worked out the application of this law in detail for a large number of brasses containing one or more of the following elements: aluminium, manganese, iron, tin, lead, silicon, magnesium, antimony, phosphorus, cadmium. More than 500 samples were examined. The practical work on the alloys included determinations of (1) microstructure—the etching re-agent employed was ferric chloride in hydrochloric acid ; (2) mechanical properties—tensile, shock, and hardness tests ; (3) forging qualities, hot and cold. The alloys were all examined as cast. For comparison the properties of the copper-zinc alloys were determined. Aluminium and manganese will dissolve in the α and β constituents of brass in large quantities. Coefficients of equivalence are as follows: Al = 6, Mn = 0·5, Fe = 0·9, Sn = 2, Pb = 1, Si = 10,

* Rev. Metallurgie, iii. (1906) pp. 243–88 (59 photomicrographs).
† Op. cit., ii. (1905) pp. 97–120.

Mg = 2. In general when several elements are added to a copper-zinc alloy, each acts as if it were the only one.

The Alloys of Antimony and Tin.*—F. E. Gallagher has investigated the freezing-point curve of the antimony-tin alloys, and finds that, contrary to Reinders' conclusions, there are no compounds between these two metals. The four solid phases are four sets of solid solutions. Sixty-three alloys were made, of different compositions. They were annealed at temperatures ranging from 218°–560° until equilibrium was reached, and examined microscopically. The nature of the phases was thus determined. The higher the temperature the more rapidly is equilibrium attained. The etching reagent most frequently employed was ferric chloride in alcoholic solution, which gave good preparations. Some of the alloys rich in tin were etched by being made the anode first in 1 p.c. nitric acid, then in an alkaline solution of sodium tartrate, the latter removing the black deposit first formed.

The Tensile Strength of Copper-Tin Alloys.†—E. S. Shepherd and G. B. Upton have studied the relationship between constitution and physical properties of the bronzes. The complex freezing point curve given is plotted from Heycock and Neville's data, modified by Shepherd and Blough. The only chemical compound in the alloys containing more than 50 p.c. copper is Cu_3Sn. Solid solutions, denoted by α, β, γ, and δ (formerly thought to be Cu_4Sn), are the other constituents. By chill casting an alloy, annealing at a given temperature for as long a time as may be necessary, then quenching, the structure and properties normal at that temperature may be determined. Tensile tests were made on the alloys (1) as cast, (2) heated for a week at 540° and quenched in water, (3) heated for a week at 400° and furnace cooled, (4) heated to about 650° and quenched. The test pieces were cast to shape in moulds of artificial graphite, which give an excellent surface on the casting. Melting was carried out in an atmosphere of illuminating gas. Occlusion of gas and oxidation are both much more serious in the alloys with more than 90 p.c. copper than in those richer in tin. A lengthy table of results of tests is given. Among the authors' main conclusions are (1) the tensile strength of bronzes consisting of pure α (87–100 p.c. Cu) is little affected by heat treatment, and increases with increased tin content; (2) bronzes with 74–87 p.c. copper are much stronger if annealed above 510° than if annealed at a lower temperature; (3) prolonged annealing tends to make the crystalline structure coarser, to decrease tensile strength and to increase ductility; (4) the strongest bronzes contain 78–81 p.c. copper and are mixtures of α and β crystals; (5) the stress strain diagram of a bronze tensile test piece shows no falling off when the maximum stress is reached. Stress increases steadily till the piece breaks. The stretch takes place along the whole length of the test piece: there is no local contraction as with iron and steel.

The paper is of value not only for the facts brought to light but also

* Journ. Phys. Chem., x. (1906) pp. 93–8 (2 figs.).
† Op. cit., ix. (1905) pp. 441–76 (7 figs.).

as a statement of the general principles which govern the relationship of constitution to physical properties of alloys.

The Iron and Steel Magazine.* — This Journal (formerly the "Metallographist") has ceased to be issued as a separate publication, having been taken over by "Electrochemical and Metallurgical Industry," with which it is now incorporated. It is a matter for regret that a journal which has rendered such excellent service in the advancement of metallography should no longer be published separately. The back volumes, all of which we believe may still be obtained, contain much of the valuable literature dealing with the application of microscopy to metals.

Measurement of the Elastic Limit of Metals.†—Guillery describes a method by which the variations in electric resistance of a test-piece are recorded during a tensile test. A current of 25–30 amperes per square centimetre of section is passed through the test-piece and a compensating resistance. A galvanometer is so connected with the test-piece and resistance that its deflections indicate variations of resistance in the test-piece. The galvanometer deflections are plotted against the loads, the elastic limit being indicated by a break in the curve. Considerable differences were found to exist between the results obtained in this manner and the figures given by the direct measurement of strain in the usual way. H. le Chatelier comments on the results.

Nickel-Chromium Steels.‡—The twenty-nine alloys examined by L. Guillet had the following analyses (approximately).

First series (9 steels):

Carbon 0·2 p.c.

Nickel	5 p.c.,	chromium	3, 10, 20 p.c.
„	12 „	„	3, 10, 20 „
„	30 „	„	3, 10, 20 „

Second series (9 steels): carbon 0·8 p.c., nickel and chromium as in first series.

Third series (5 steels): carbon 0·3 p.c., nickel 2·5 p.c., chromium 0·5–5 p.c.

Fourth series (6 steels): carbon 0·2 p.c., nickel 5–6 p.c., chromium 0·5–6 p.c.

The microstructure and mechanical properties of these steels are generally such as might be inferred from the properties of nickel steels and chromium steels, both of which have been investigated by the author. The effect of the chromium is added to that of the nickel. The following percentages are equivalent: 1·65 carbon, 29 nickel, 18 chromium. Pearlitic nickel chromium steels are harder when quenched than pearlitic nickel steels in the same state. γ-iron nickel chromium steels have a higher elastic limit than γ-iron nickel steels.

Etching Velocity of Metallographic Reagents.§—A number of etching reagents investigated by Kourbatoff,‖ chiefly alcoholic solutions

* Electrochem. and Met. Ind., iv. (1906) p. 253.
† Rév. Metallurgie, iii. (1906) pp. 331–42.
‡ Tom. cit., pp. 462–84 (17 photomicrographs).
§ Tom. cit., pp. 426–7.
‖ See this Journal, 1905, p. 392.

of organic nitro compounds, were found to act slowly and to give fine preparations. A relationship was observed between the speed of etching and the degree of molecular dissociation of the liquid. P. Lejeune, following up this point, indicates the effect of viscosity and dielectric constant. By etching exactly similar pieces of steel under identical conditions, using different reagents, the etching velocity of the solutions may be compared; 4 p.c. solutions of picric acid in acetonitrile, propionitrile, methyl-alcohol, and ethyl-alcohol were compared; the order given is that of their activity, the last being the slowest in etching. This is the order given for the electric conductivity of solutions of sodium chloride in these liquids. It is necessary when comparing the etching velocity of such solutions that the solvents should be anhydrous, traces of moisture increasing the ionisation. A method of photographically recording the progress of etching is suggested.

Iron-Nickel-Manganese-Carbon Alloys.* — H. C. H. Carpenter, R. A. Hadfield, and P. Longmuir give as the seventh report to the Alloys Research Committee, the results of an exhaustive investigation of the properties of ten alloys containing 0·79 to 1·03 p.c. manganese, 0·4 to 0·52 p.c. carbon, nickel varying from 0 to 19·9 p.c. The results of numerous mechanical tests and physical measurements are fully set out in tables and as curves. The range of solidification and the critical ranges on heating and cooling were determined. The lowering of the critical range on cooling is fairly uniform up to 4 p.c. nickel. Further increase of nickel causes a change of character in the cooling curves, the critical ranges being spread over a wide interval of temperature. The authors' metallographic results agree on the whole with Guillet's.† A 5 p.c. solution of picric acid in alcohol, used at the outset as an etching reagent, was replaced by 1 p.c. nitric acid in alcohol, giving the same results more quickly. The alloys were examined as forged, and after being thermally and mechanically treated in various ways; they are classified as follows:—

Cast alloys ..	0 to 5 or 6 p.c. nickel ..	Pearlitic
	5 or 6 to about 16 p.c. nickel ..	Martensitic
	Over 16 p.c. nickel	Polyhedral
Forged alloys ..	0 to 4 p.c. nickel	Pearlitic
	5 to 20 p.c. nickel	Martensitic

No evidence for the existence of a carbide of nickel was found. The effect of mechanical work on the alloy with 19·9 p.c. nickel was to change its microstructure and cause it to become magnetic. A dark etching constituent was produced. The alloy previous to deformation gave a white polyhedral structure on etching. The polyhedral structure is restored wholly or in part by heating at 900° C. J. O. Arnold criticised the authors' method of taking critical range curves.

PEIRCE, B. O.—**On the Permeability and the Retentiveness of a Mass of Fine Iron Particles.** *Proc. Am. Acad. Arts and Sci.*, xlii. (1906) pp. 87–91 (2 figs.).

OSMOND, F.—**French Contributions to the Progress of Scientific Metallurgy.** [Recent metallographical research in France is briefly reviewed in this paper.] *Rev. Metallurgie*, iii. (1906) pp. 365–81.

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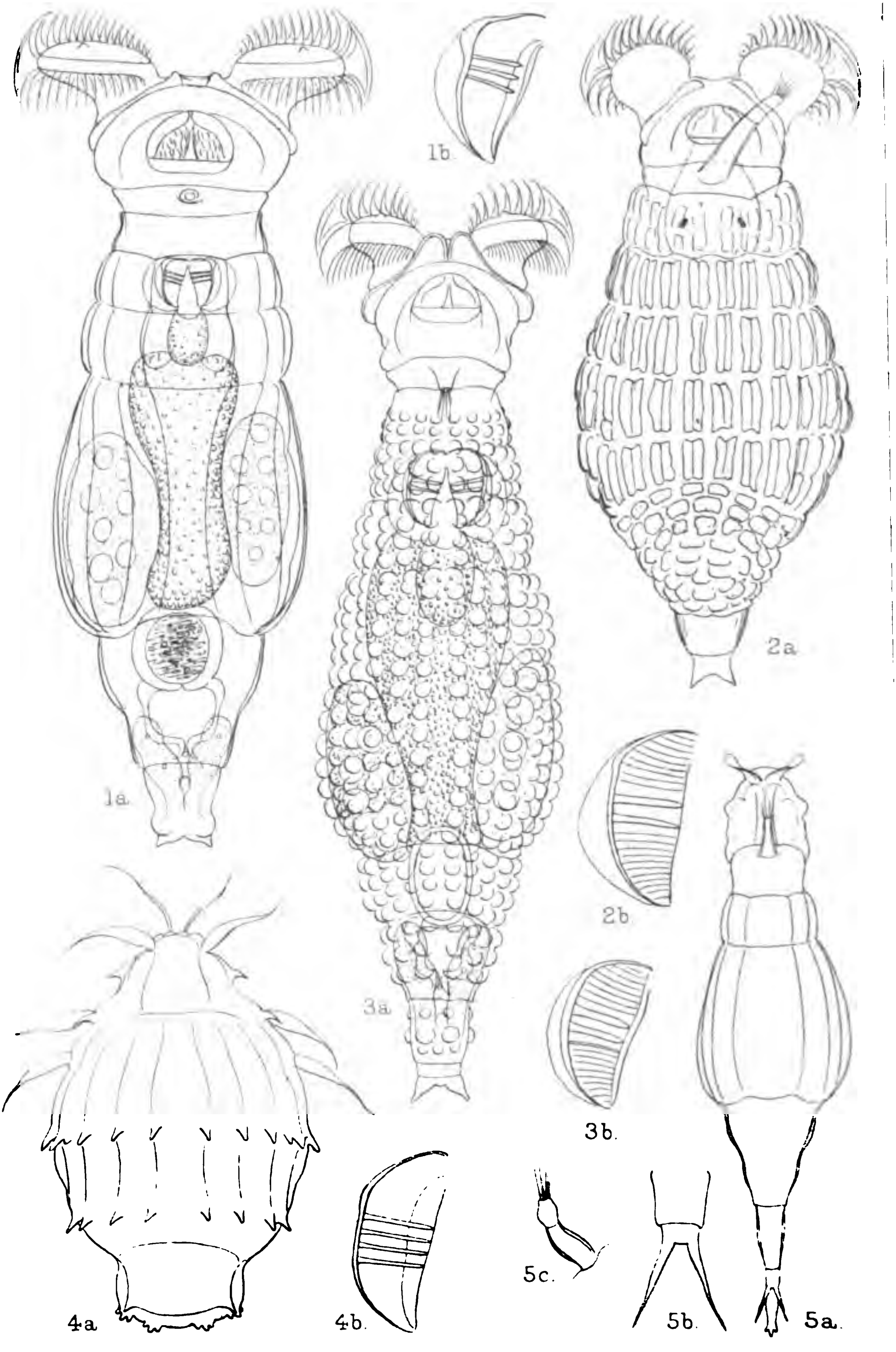
* Proc. Inst. Mech. Eng., 1905, pp. 857–959 (87 figs.); discussion, pp. 959–1041.
† Bull. Soc. de l'Enc., 1903.



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Indian Rotif...

JOURNAL

OF THE

ROYAL MICROSCOPICAL SOCIETY.

DECEMBER, 1906.

TRANSACTIONS OF THE SOCIETY.

XII.—*Some Rotifera of the Sikkim Himalaya.*

By JAMES MURRAY.

Communicated by C. F. ROUSSELET.

(*Read October* 17, 1906.)

PLATES XVIII. AND XIX.

BY the kindness of Mr. N. D. F. Pearce, I was allowed the privilege of examining, early in this year, 1906, a large series of samples of moss recently received from India. There were 30 packets of moss, from six localities, at elevations of 2000 to 8000 feet.

Mr. Pearce had examined the moss for Oribatidæ, etc., and published his interesting results in the Journal of this Society (1906, p. 269). I understand that Mr. Pearce subjects the moss to considerable heat in the course of his examination, and was,

EXPLANATION OF PLATE XVIII.

Fig. 1*a*.—*Philodina indica* sp. n. Dorsal view.
„ 1*b*. „ „ Jaw.
„ 2*a*. „ *squamosa* sp. n. Dorsal view.
„ 2*b*. „ „ „ Jaw.
„ 3*a*.—*Callidina formosa* sp. n. Dorsal view.
„ 3*b*. „ „ „ Jaw.
„ 4*a*. „ *multispinosa* Thompson. Variety.
„ 4*b*. „ „ „ Jaw.
„ 5*a*.—*Adineta longicornis* sp. n.
„ 5*b*. „ „ „ Spurs.
„ 5*c*. „ „ „ Antenna.

therefore, apprehensive that all the Rotifers might have been destroyed. In this I was agreeably disappointed. In 21 of the packets Rotifers were found, and in all but one of these the examples were living. Of Bdelloida, 31 species were recognised, and of Ploïma, 5.

Previous experience of arctic, antarctic, and European Rotifers had disposed me to expect little local peculiarity among Bdelloid Rotifera from any part of the world. The Rotifers from India, however, included a number of peculiar species not previously known, and more recent work on mosses from another hot climate, British Guiana, showed that there also were peculiar species, in one instance identical with an Indian species. Of the 31 Bdelloids, 11 species are undescribed; of these, 5 had been previously discovered in Europe by Mr. Bryce, 5 are here described, and one is reserved for further study.

Besides the 31 species, there were 3 well-marked varieties, which are here named and described. Most of the known species which were found occurred as varieties differing more or less widely from the types.

No Rhizota and few Ploïma were found. These do not survive desiccation like the Bdelloids, and those found were probably hatched from eggs.

List of Species.

Bdelloida.

Philodina indica sp. n., plate XVIII. figs. 1*a*, 1*b*.

Specific characters.—Large, stout, no eye-spots; corona very broad, exceeding trunk, disks large, with central papillæ, widely separated; length of antenna equal to $\frac{3}{4}$ diameter of neck; jaws constricted near the upper margin, teeth 3/3, slightly enlarged towards the points; foot very short, three-jointed, second joint with annular swelling, from which arise the short conical spurs; vibratile tags small, narrow; toes 4.

Length, when creeping, 430 μ, diameter of corona 140 μ, length of jaw 22 μ.

Although at a first glance apparently lacking in very marked characters, when the species is compared with the rest of the genus it is seen to be sufficiently well characterised. The lack of eyes marks it off from the majority of the species. The parasitic group (*P. laticeps*, *P. hamata*) is distinguished by the long foot. larger spurs, dental formula, etc. The semi-loricated group (*P. alpium*, *P. brycei*, *P. humerosa*) is separated by the thick integument of the trunk, with strong longitudinal and transverse folds. The only two species closely approaching *P. indica* are *P. plena* (Bryce) and *P. vorax* (Janson). From *P. vorax*, which it resembles in the large

size and ample corona, it differs in the form of spurs and the dental formula. *P. plena,* which has somewhat similar spurs, has a much smaller corona, teeth 2/2, and upper lip of different form.

Structures not referred to are as normal in the genus, or can be best seen in the drawing.

The animal is transparent, of a pale yellowish or reddish colour, the skin-folds broad and faint.

Abundant in one sample of moss, the dental formula was invariably 3/3, so this number may be considered normal. Baghghora, elevation 6000 ft.

Philodina squamosa sp. n., plate XVIII. figs. 2*a*, 2*b*.

Specific characters.—Small; narrow brown eyes, trunk viscous, secretion in form of thin irregular oblong plates, defined by the longitudinal skin-folds and the division of the segments, corona moderate, less than trunk, disks large, with moderate sulcus. Antenna as long as diameter of neck, or longer. Foot short, three-jointed, spurs moderate cones, toes four. Teeth 2/2.

In size like *P. humerosa* (*7*),* it has most resemblance to the group which includes that species. It differs from the three species of the group in the possession of eyes, and in the viscous secretion. Each plate has a median line, and looks like two pages of an open book. The secretion is easily washed off. Owing to the habit of holding the disks inclined to the dorsal side, the upper lip is not properly seen, but it is hoped the species will be recognisable from the sketch and description given.

Darjiling, elevation 6000 ft., fairly abundant in one collection.

P. citrina Ehr. — Abundant in collection from Darjiling, 6000 ft. Most of the examples were destitute of colour, but a few were of the usual colour. The spurs were somewhat long for the species.

P. brevipes Murray.—This species hatched out abundantly after the collections had been mixed, so that the precise locality cannot be known. All were beautifully hyaline and free from parasites.

P. flaviceps Bryce (*4*).—In two collections from Darjiling and Baghghora, 6000 ft.

P. vorax Janson (*5*).—In two samples from near Darjiling, 6000 to 6500 ft., fairly abundant in one of them.

Philodina laticeps Murray.—This parasite on Crustacea and Insects was found in one sample only, from Darjiling, 6000 ft. It had more teeth than the type, formula $\frac{2+1}{1+2+1}$, the additional teeth slender. The host was not found.

* The figures in brackets refer to list of literature at end of paper.

Callidina perforata sp. n., plate XIX. figs. 11*a* to 11*c*.

Specific characters.—Small, food moulded into pellets, inhabiting case secreted from the skin; case brown, shortly oval, with short neck and slightly expanded mouth, drawn out at posterior end into a short tube, which is bent towards the dorsal side, perforated at the tip, which has two pointed lips, like the spout of a tea-pot. Neck long, lower lip a small spout, disks strongly inclined back, rostrum short, antenna equal 3/5 of neck, gullet short; teeth 5/5 or 4/4, trunk dorsally plicate, egg elliptical.

Having some affinity with *C. angusticollis*, it yet differs in almost every part of its organisation. The remarkable case is quite unique. It fits so closely to the trunk that the plicæ are seen even in the empty case. It is very remarkable that the open tube at the posterior end is turned to the dorsal side, as the foot of all Bdelloids is turned to the ventral side. This is opposed to the idea that the perforation is for the protrusion of the toes, and gives colour to the suggestion of Mr. Bryce, that it serves solely to get rid of the voided pellets. There is a trace of lamination at the neck of the case. Empty cases usually lack the ventral wall of the trunk. The gullet is unusually short for a pellet-maker, so that, when feeding, the jaws are well out of the case, while in *C. angusticollis* they always remain in the central trunk.

Abundant in several collections from different elevations in the Himalaya, Darjiling 6000 ft., Sukvar 4000 ft., Singlà 2000 ft.

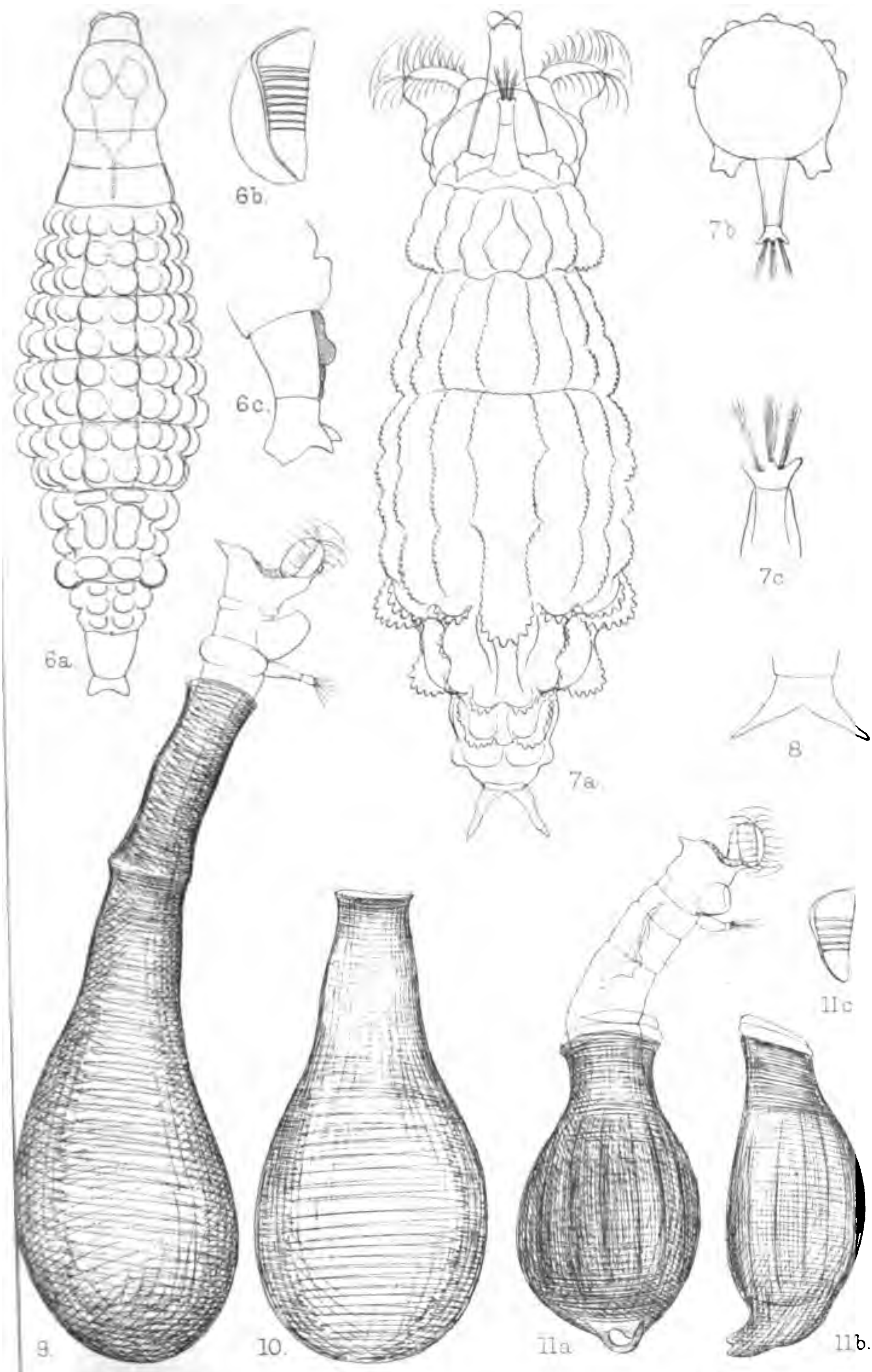
Callidina angusticollis Murray, var. *attenuata* var. n., plate XIX. fig. 9.

Distinctive characters.—Animal of same size as type, but case greatly elongate at the neck, so that when feeding the head only is exserted.

C. angusticollis, type (fig. 10), when feeding, has the head far out of the case, the greater part of the neck also showing outside, the case in fact ceasing at the base of the neck. In the variety *attenuata*, though the neck is no longer, the case extends two

EXPLANATION OF PLATE XIX.

Fig. 6*a*.—*Callidina crenata* var. *nodosa*.
,, 6*b*. ,, ,, Jaw.
,, 6*c*. ,, ,, Lateral view of foot.
,, 7*a*.—*Rotifer longirostris* Janson var. *fimbriata*.
,, 7*b*. ,, ,, ,, ,, Section of neck.
,, 7*c*. ,, ,, ,, ,, Antenna.
,, 8. ,, ,, ,, Spurs of variety.
,, 9.—*Callidina angusticollis* var. *attenuata*.
,, 10. ,, ,, ,, Type.
,, 11*a*. ,, *perforata* sp. n. Case in dorsal view.
,, 11*b*. ,, ,, Lateral view of case.
,, 11*c*. ,, ,, Jaw.



J. Murray del.ad nat.

West, Newman photo-lith.

segments higher on it. As the case is believed to be secreted by pores scattered all over the portion of the trunk to be protected, the elongation indicates a great physiological change. Two segments of the neck must possess these pores, which in the type produce no secretion. While many cases are smooth and evenly tapering, some are distinctly bent at each of the extra neck-segments, the portion below the lower bend being exactly like the type case.

Extremely abundant in one collection from Baghghora, 6000 ft. Many were seen feeding. Type also frequent in many of the samples.

C. crenata Murray (*7*), var. *nodosa* var. n. (plate XIX. figs. 6*a* to 6*c*).—Distinguished from the type by the very large size of the tubercles. These are about eight times the diameter of those of the type. Only eight rows were counted in the length of the trunk. They give the animal a remarkable appearance. It is likely to prove of specific rank, but as it has not been seen to feed, and I have detected no other peculiarity, I prefer to provisionally unite it with *C. crenata*. The bosses on the rump are as in the type, but they are obscured by the large size of the adjoining tubercles. In one sample only, Gokdhara, 3000 ft.

Callidina aspera Bryce (*1*).—Frequent in the two collections from the greatest elevation, Darjiling 6500 ft., and Sinihul 8000 ft.

C. lata Bryce (*1*).—The spurs were more acuminate and blunter than in the type. Abundant in one sample from Sinihul, 8000 ft.

C. leitgebii Zelinka (?).—A few examples from two stations at 6000 ft., Darjiling and Baghghora, are referred to this rather obscure species.

C. microcephala Murray (*8*).—One or two examples only from Darjiling, 6000 ft.

Callidina formosa sp. n., plate XVIII. fig. 3*a*, 3*b*.

Specific characters.—Large, elongate, colour reddish, trunk and first foot-joint covered with hemispherical processes of uniform size, regularly arranged in longitudinal rows. Corona moderate, disks with central papillæ. Upper lip of two elevated rounded processes, meeting in the middle line. Collar very prominent, a prominent lateral fold overhanging the neck. Length of antenna equal half diameter of neck. Teeth 2/2. Foot of four joints, spurs acuminate, blunt, slightly separate at base; toes three. Food not moulded into pellets. Egg elliptical, with a rounded projection at each pole. Length 480μ, diameter of corona 77μ, of neck 50μ, centre of trunk 94μ, across jaws without wings 35μ, length of jaw 32μ, across spurs, point to point 23μ, tubercles 5–7μ.

Closely related to *C. habita* Bryce (*2*), the only species with which it need be compared. The general form, corona, upper lip,

spurs, and egg, are all exactly as in that species. The points of difference are the tubercled skin, more prominent collar, and especially the hanging "dewlap" at the side of the head, overhanging the first neck segment. Other structures are normal.

Very abundant in moss from Darjiling, elevation 6000 ft.

Callidina quadricornifera Milne (*6*).—Abundant in many collections. In most of these it was of a very large size, with strongly stippled skin. The skin of the trunk is very firm and retains its form after death, when the softer extremities have decayed, forming, in fact, a kind of lorica. In these skins the stippling becomes perforation. The teeth are very broad.

C. papillosa Thompson (*10*).—Found at three stations, Sinihul, Darjiling, and Baghghora, but rare compared with the next species.

C. multispinosa Thompson (*10*).—One of the commonest species in all the localities. The type was rare, but there were a great many varieties, differing in the size, number, and form of the spines, some approaching *C. papillosa*. The extreme varieties would have been considered as of specific rank, but the great number of intermediate forms made it impossible to give even varietal names to them.

The commonest variety is figured (plate XVIII. figs. 4*a*, 4*b*). The spines are few, the principal anterior and lateral ones have very thick bulbose bases and short points. The short spines on the pre-anal form little fimbriate combs as in *P. spinosa* Bryce. Teeth 4/4; size small.

Another variety (not figured) has all the anterior spines reduced in size, and those on the pre-anal very conspicuous and single.

A third variety has the lateral processes on the anterior edge of the trunk expanded into broad ovate bodies, all the other anterior and lateral processes short and thick.

A fourth variety has all the spines as short as in *C. papillosa*, but still acute, and the skin not papillose.

C. plicata Bryce (*1*).—This occurred as a variety. of reddish colour, with the pre-anal processes inconspicuous. The first foot-joint had a dorsal prominence at the posterior margin, not quite a boss. Close above the spurs is a similar dorsal projection of smaller size. Otherwise typical. Darjiling, Baghghora, and Gokdhara.

Callidina habita Bryce (*2*).—This species and the variety *C. bullata* Murray (*9*) were found in the mixed collection, so the precise locality is not known. The variety is precisely like the examples from Loch Treig.

C. musculosa Milne (*6*).—At Baghghora were found several examples which I refer doubtfully to this species. The species seems to have much resemblance to *C. symbiotica*.

Rotifer longirostris Janson (*5*).—The type and several varieties were common in nearly all the collections. The type was commonly much encrusted with extraneous matter, and in some examples

grains of sand were so regularly arranged along the skinfolds, with larger pieces at prominent angles, that it seemed as though the animal had some power of selection.

Var. *fimbriata* var. n. (plate XIX. figs. 7*a* to 7*c*).—The anterior portion of the trunk is expanded into a large ruff. The longitudinal skinfolds from this ruff to the pre-anal segment are fimbriate with little close-set processes, which are very large at the more protuberant segments, the ruff, the next segment to it, the fourth central, and the pre-anal. These processes are apparently the result of a secretion, but their definite form and symmetry of arrangement are remarkable. The processes on the neck, at each side of the antenna, are large and bifid.

A variety (fig. 8) has the spurs short, widely divergent, and free from the stippling which characterises the type.

Rotifer vulgaris Schrank.—One example was found in the mixed collection, so that precise locality and elevation are unknown.

Adineta vaga Davis.—Variety *minor* Bryce, which is said to be Davis's type, found at one station, Gokdhara, 3000 ft., variety *major* Bryce, Sinihul, 8000 ft., and Darjiling, 6000 ft.

A. longicornis sp. n. (plate XVIII. figs. 5*a* to 5*c*).—Small, rather short, form similar to that of *A. vaga* Davis (type = var. *minor* Bryce). Spurs relatively longer than in any of the other species (about $\frac{1}{16}$th of total length), very slender and acute, separated by a short, straight interspace. Head and rostrum of peculiar form, best seen in the figure (5*a*). Length about 300 μ, spurs 18 μ. The detail of the rostrum was not fully made out, but its form is as shown. Abundant at Gokdhara, 3000 ft.

Ploïma.

Furcularia rectangularis Glascott.—One example, Darjiling, 6000 ft.

Stephanops tenellus Bryce (*3*) (for figure see *9*, plate v., fig. 19). —One example, Gokdhara, 3000 ft. Broader than usual in the middle of the trunk, making the general form rhomboid.

Colurus leptus Gosse.—In the mixed collection, abundant.

Monostyla lunaris.—Frequent in samples from Baghghora.

Brachionus urceolaris Ehr.—In mixed collection, one example.

Besides these five species, there were two species of *Diaschiza*, and two of *Monostyla*, which I was unable to identify.

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XIII.—*Note on an Early Criticism of the Abbe Theory.*

By A. E. CONRADY, F.R.A.S., F.R.M.S.

(*Read October 17th,* 1906.)

THE study of Abbe's collected papers directed my attention to a contribution on microscopical theory by Dr. R. Altmann,* then Prosector at the University of Leipzig, which appeared in the year 1880.

This paper deals with the optics of the human eye, of the telescope, and of the photographic camera, as well as with the theory of the Microscope, and represents an attempt at bringing all these under one universal rule, viz. that their images are composed of "diffusion disks," formed according to Helmholtz's theory of 1873, which latter, it may be remembered, appeared immediately after Abbe's famous paper of the same year.

Helmholtz had assumed that the Microscope objective was completely filled with light, and arrived at the size of the spurious disk and the consequent limit of resolution on that assumption. Altmann, who, as a practical microscopist, knew that this condition is hardly ever fulfilled in actual practice where only a part, and often a very small part, of the objective is filled with direct light, tried to extend the Helmholtz theory so as to include these cases. For this purpose he pointed out that the incident light is refracted, reflected, and diffused by the structural elements of the object, and that the light is thus spread out sufficiently to more or less completely fill the otherwise dark space surrounding the direct light in the aperture of the objective as seen when looking down the tube. He does not attempt a rigorous solution of the problem of computing the form of the spurious disk under these conditions, i.e. when the light is of different intensity in different parts of the aperture; he assumes that it does not differ very much from the size and nature found by Helmholtz for a uniformly filled objective. He only states (page 164 of his paper) that when, owing to regular diffraction by the object — as, for example, with *Pleurosigma angulatum*—the light is broken up into distinct maxima, then the spurious disk will be the same as if we looked at a point of light through a telescope with a correspondingly perforated screen in front of it.

Altmann's theory thus tries to account for the image under all conditions on Helmholtz's basis, viz. that each point in the object

* Zur Theorie der Bilderzeugung. Archiv für Anatomie u. Physiologie, anatomische Abteilung, 1880, pp. 111-184.

is, in the image, represented by a more or less modified spurious disk, and that the image, therefore, is built up of a continuity of overlapping spurious disks, precisely as the telescopic image of the sun, a star-cluster, or a nebula.

For the Abbe theory Altmann has little but smiles and sneers; it is, however, only just to remember that he had only the exceedingly brief and fragmentary account of it in the paper of 1873 to base his opinion upon; and when this is borne in mind, there seems some excuse for Altmann's verdict that Abbe had based very broad claims on very little evidence. He raises various objections, as, for instance, that even where there is diffraction by the object (which in general he denies), it is only necessary to use a full cone of illumination in order to smother the diffraction spectra in a flood of direct light; and tries to clinch matters by describing (on page 165 of his paper) an experiment with the aerial image of a grating which, he considers self-evident, cannot produce any diffraction spectra, and which, nevertheless, forms a perfect image when viewed through the Microscope. At the present time the chief interest in this paper of Dr. Altmann lies in the fact that it drew an immediate and characteristically vigorous reply from Professor Abbe.*

Abbe here departed from the purely experimental style of his first communication, and for the first (and, unfortunately, last) time insisted on the difference between self-luminous objects and those illuminated from a separate source of light, and pointed out how this difference was the real distinction between his theory and that of Helmholtz.

For the first time it was made clear to those acquainted with the undulatory theory of light, that the "diffraction theory" was a necessary and inevitable deduction from the fundamental principles of the accepted theory of light.

Only light from the same luminous point is in that condition of a permanent phase-relation which must be fulfilled if any regular co-operation between the several portions of light passing through an objective is to be possible. Before applying the theory of Helmholtz—and, still more, elaborations of it—it must therefore be proved that the light emanating from any one point in the object is in this condition. This proof is impossible, for an examination of the conditions prevailing in the Microscope shows that an entirely opposite state of affairs prevails: different points in the object receive light from the same point in the necessarily more or less distant source of light, whilst any one point in the object receives light from different luminous points, which is therefore incapable of co-operating in the manner assumed by Helmholtz, and before him by Airy.

* Uber die Grenzen der geometrischen Optik: Sitzungsberichte der Jenaischen Gesellschaft für Medizin und Naturwissenschaft, 1880, pp. 71–109.

Abbe, moreover, dealt with a number of other points raised by Altmann, and pointed out his errors; it is interesting to note among these the case of the aerial image of a grating; here Abbe points out that the original grating produces diffraction spectra, and that these, as well as the direct light, are refracted by the lens forming the aerial image, and thus supply this latter with an exactly similar set of diffraction spectra. He, moreover, insists that when the same experiment as described by Altmann is made with a white-hot, and therefore really self-luminous grating, totally different results are obtained.

For this Society there is a further interest in Altmann's paper, inasmuch as it obviously represents a singularly complete anticipation of a paper read before it more than twenty years later by Mr. J. W. Gordon. Altmann's modified diffusion-disks are completely identical with Mr. Gordon's "antipoints," and it will be noted that even the arguments employed are very similar in many cases. It is, of course, not even remotely suggested that Mr. Gordon had plagiarised Dr. Altmann—it merely shows once more how two minds may work in exactly the same way, although perfectly independently.

In conclusion, I may say that Altmann published two brief attempts at a reply to Abbe's rejoinder: in the "Archiv," in which the original paper appeared, the first of these replies is to be found in the volume for 1880, the second in that for 1882; the point which Abbe had put in the forefront—the difference between a self-luminous object and one illuminated from a distance—is not even mentioned in either of these replies!

NOTE.

Notes on the Markings of the Wing-scales of a certain Butterfly.

By Dr. Alfred C. Stokes.

In this Journal for August, 1895, Mr. Alfred Letherby, F.R.M.S., published a paper entitled "Notes on the Podura Scale," in which he says that this scale is formed of two membranes: "one a delicate hyaline membrane from which the stalk extends; and one a denser (optically) brownish membrane superimposed upon the other. The latter is perforated all over in the form known as exclamation marks." And he presents photographs to substantiate his contention.

While every observer of the Podura scale has probably seen the appearances that he pictures and describes, the explanation seems to be original with Mr. Letherby. And from what I have recently observed on the scales of another insect, if I may judge from analogy, Mr. Letherby's interpretation is correct.

For a number of years a slide labelled "Butterfly's wing dust," has been in my possession, but until recently it has not been examined with any care. I have no knowledge as to the history of the slide, nor the origin of the wing-scales. This is to be regretted, as a further supply would be desirable, since the structure of the scales, while rather more complicated than that described by Mr. Letherby, in regard to the Podura scale, is important when considered in connection with his interpretation.

These special wing-scales are formed of three distinct membranes, of which the upper and the lower bear longitudinal ribs, between which both membranes are distinctly, even conspicuously perforated by minute apertures arranged in rows more or less horizontal. Some of the scales in the preparation have the two margins accidentally turned upward, so that both membranes may be readily examined. Others, accidentally torn, show the postage-stamp fracture with equal distinctness.

The longitudinal ribs appear to be externally directed folds or elevations of both membranes. Those on one surface pass around the stem-bearing end of the scale, and are continuous with the corresponding ribs on the other. The perforations cease at a considerable distance from the posterior, or stem end, so that in that region the membranes show no markings, except these ribs, and, in certain instances, several oblique-folds or wrinkles.

The third membrane is intermediate between the two perfor-

ated surfaces, and is structureless. It appears to be connected with the upper and the lower membranes at the front, and at the two lateral margins of the scale, but not at the posterior extremity, to which it does not fully extend, stopping short of that margin by a considerable interval. Its function seems to be to stiffen and to support the two perforated membranes, which are so exceedingly delicate, and so susceptible to injury, that the process of mounting them in balsam has in many instances stripped them from the structureless basement membrane, leaving it bare and conspicuous, with only a few perforated fragments scattered over its surface.

TRENTON, NEW JERSEY, U.S.A.

SUMMARY OF CURRENT RESEARCHES

RELATING TO

ZOOLOGY AND BOTANY

(PRINCIPALLY INVERTEBRATA AND CRYPTOGAMIA),

MICROSCOPY, ETC.*

ZOOLOGY.

VERTEBRATA.

a. Embryology.†

Origin of Sex-Cells of Chrysemys.‡—Bennet M. Allen finds in *Chrysemys marginata* the first appearance of primitive sex-cells in the hypoblast at the edge of the area pellucida, in a zone extending on each side from a point opposite the anterior portion of the pronephros, to a point behind the embryo.

They migrate within the endoderm to a point immediately below the notochord, from which a large proportion of them continue upward in the mesentery. The great majority of these reach the sex-gland primordium in the peritoneum on each side of the root of the mesentery.

In both ovary and testis, many of the sex-cells are carried into the sex-cords, where they give rise to spermatogonia in the testis, and probably degenerate in the ovary. In the testis most of the sex-cells come to be in the sex-cords, while in the ovary the majority remain in the germinal epithelium, there to become oogonia. Those that remain in the peritoneum of the testis degenerate.

The sex-cells lie among the peritoneal cells, but are not derived from them. No essential differences in origin or character were to be observed between oogonia and spermatogonia.

History of Division Centres in Fertilisation.§—K. Kostanecki has inquired into the question of the origin of the division centres of the first segmentation spindle in fertilisation. For research material he used *Myzostoma glabrum*, and from his results here and from other

* The Society are not intended to be denoted by the editorial "we," and they do not hold themselves responsible for the views of the authors of the papers noted, nor for any claim to novelty or otherwise made by them. The object of this part of the Journal is to present a summary of the papers *as actually published*, and to describe and illustrate Instruments, Apparatus, etc., which are either new or have not been previously described in this country.

† This section includes not only papers relating to Embryology properly so called, but also those dealing with Evolution, Development, Reproduction, and allied subjects.

‡ Anat. Anzeig., xxix. (1906) pp. 217–36 (15 figs.).

§ Arch. Mikr. Anat., lxviii. (1906) pp. 359–431 (2 pls.)

sources he concludes that in the fertilised egg of all Metazoa the centrioles of the first segmentation spindle are the direct descendants of the centriole introduced by the spermatozoon. Contrary views are due to too limited observations; the time of appearance of the sperm centrum is very variable and is apt to be missed, and the figure of the sperm radiation may vary from the moment of origin to the time of complete formation of the spindle.

Impregnation and Fertilisation.*—E. Bataillon has made experiments with the eggs of *Pelodytes punctatus* brought into contact with spermatozoa of *Rana*, *Bufo*, and *Triton*. In one case the eggs of *Pelodytes* were impregnated by spermatozoa of *Triton alpestris*, and underwent irregular segmentation, the peculiarities of which are described. The same spermatozoa had the same results on the ova of *Bufo calamita*. In both cases the impregnation was followed by a degeneration of the spermatozoon; in the abnormal development the stock of chromatin is derived from the female pronucleus. Impregnation has a physiological role distinct from that of amphimixis.

Trophoblast of the Placenta.†—Eternod finds that in *Homo*, many Primates, and many other mammals, the ovum rapidly penetrates the epithelium of the uterus, and encapsules itself in the mucosa, surrounding itself with a thick syncytial, epithelial envelope, formed from the ectoderm. This trophoderm or trophoblast persists throughout the whole period of gestation, and its history is briefly outlined. Chorionic villi grow into the trophodermic epithelial mass; the trophodermic lacunæ nearest the chorion dilate, and become reservoirs of maternal blood; the deep plasmodial layer of the trophoderm bordering the chorion gives rise to two layers—one of distinct cells and one syncytial; the peripheral layer of the trophoderm continues to proliferate continuously, and gives rise to more or less extensive plasmodial or syncytial prolongations; one part of the superficial plasmodial layer adheres to the uterine wall at the "Haft-Zotten."

Absorption of the Yolk in Anguis fragilis.‡—Ludwig Cohn finds that in the slow-worm shortly before hatching, the residue of the yolk-sac hangs in the body-cavity connected only with the mesenteric veins. The assimilation of the yolk occurs in the epithelial cells of the folia of the yolk-sac wall, which it enters in diffuse form, uniting again into larger spherules. In structure and disposition the folia resemble those of *Lacerta*.

Gastrulation of Horned Toad.§—Charles L. Edwards and Clarence W. Hahn have studied embryos of *Phrynosoma cornutum* Harlan. It is not viviparous, as usually stated, but lays its eggs (up to 25) in nests formed in a chamber at the end of a tunnel which the female burrows. The general process of gastrulation is similar to that in other reptiles, but there are some striking differences. The egg stands in closer relation to the lower Vertebrates than any other amniote, in that the protoplasmic

* Comptes Rendus, cxlii. (1906) pp. 1351-3.
† Arch. Sci. Phys. Nat., xxi. (1906) pp. 639-41.
‡ Zool. Anzeig., xxx. (1906) pp. 429-40 (6 figs.).
§ Amer. Journ. Anat., v. (1906) pp. 331-51 (15 figs.).

pole of the egg seems less encumbered with yolk; the blastoderm at least is so elevated that processes going on in it are quite as independent as in the amphibian egg. Among other points of interest, it may be noted that there is practically no evidence in *Phrynosoma* that either the chorda or hypoblast contributes anything toward the origin of the mesoblast.

Terminology of Organs in Various Conditions of Development.* J. H. Schaffner has made a useful attempt towards greater precision of terminology. An "incipient" organ is one in its first stages of development in the life of the individual, and "incept" is proposed as a synonym for primordium or anlage. A "nascent" organ is one at the beginning of its evolution. A "vestigial" organ is one which was normally developed in the past history of the race, but which has become permanently reduced, never developing completely in an individual. An "abortive" organ is one normal in the species, but which has failed to reach full development in the individual. An "atrophied" organ is one which is normal in the species and fully developed in the individual, but which has become reduced through pathological conditions or through disuse. Imperfectly developed or reduced organs of all types may be called rudimentary. A "rudimentary" organ is one in an initial, incipient, or incomplete state of development; or one that has become reduced either in the history of the race or of the individual. "Atavistic" organs are such as show in the individual a return to some ancestral type. "Retrogressive" organs are such as are passing from a higher to a lower or less perfectly developed condition or state of organisation. "Abnormal" organs are those which deviate from the usual type in some extraordinary way. A "malformed" organ is an unusual growth due directly to some external condition in the life of the individual. "Transformed" organs are such as show a change in the individual or the race from one type of structure or function to another. "Insect wings are probably transformed gills," the author says. "Juvenile" organs appear in the young, but are absent in the adult.

Movements of Snake Spermatozoa.†—H. Adolphi, continuing his observations on the movements of spermatozoa, finds that in the adder, as in many other forms, the spermatozoa swim against a current. Rates of 50–80 μ per second were observed. The habit of moving against currents doubtless helps in the ascent of the oviduct.

Development of the Retina in the Salmon.‡—C. M. Fürst distinguishes three chapters in the development of the retina. (1) The cylindrical epithelium stage; (2) the differentiation stage; and (3) the growth stages in which the rods and cones are formed. Each of these stages is described in detail. The first stage is marked by cell-multiplication; the second by the integration and displacement of cells; the third by the growing out of the terminal organs of the visual cells (rods and cones), and by changes in the shape and size of all the retinal cells.

* Ohio Naturalist, vi. (1906) pp. 541–4.
† Anat. Anzeig., xxix. (1906) pp. 148–51.
‡ Acta Univ. Lund., xl. (1904, received 1906) pp. 1–45 (2 pls.).

Experimental Studies in Development of Eye and Nasal Cavity.* E. T. Bell has performed a number of delicate experiments on frog embryos, such as removing half the anterior brain and optic vesicle, turning the optic vesicle round, making the normally inner pole lie outwards, implantation of the optic vesicle of another embryo, and such like. Some of the conclusions deduced from the results which followed are that a small eye may develop in place of one removed; the retina may certainly be regenerated in very young embryos after removal of its entire anlage; a typical lens (with lens fibres and epithelium) may be formed (1) from the pigment layer of the retina; (2) from the brain tissue of another embryo; (3) from the ectoderm dorsal to the mid-brain region; (4) from the cord of ectodermal cells forming the primordium of the nasal organ. From analogous experiments the evidence indicates, though it does not definitely prove, that the nasal primordium develops independently of both brain and pharynx, and that its connection with these organs is brought about later by stimuli arising after the various structures have come into relation with each other.

Development of Thyroid in Bdellostoma stouti.†—C. R. Stockard finds that the thyroid arises as a long trough-like anlage extending over a relatively long gut area, a form probably related to the number of the gills and the extent of area occupied by them. Later, the trough becomes a more or less continuous chain of cell-groups, as if the body of the trough-like evagination, after pinching away from the pharynx floor, had begun to break down or disintegrate into small groups of cells. The nuclei of all the cells in the thyroid tissue are much larger and stain more deeply than those of the mesenchyme cells among which they lie. In an embryo just hatched the thyroid is seen to be in almost the adult condition. It consists of diffusely scattered alveoli below the pharynx and above the median branchial artery. The manner in which the groups of cells produce the alveoli is strikingly analogous to the way in which the morula of a holoblastic egg passes into the hollow blastula stage. There is nothing in the development of the thyroid in *Bdellostoma* to suggest a paired origin for this organ.

Primitive Occipital Vertebræ.‡—R. Froriep discusses the question of the homology of the occipital "Urwirbel" of the Amniota and of the Selachii, the problem as to the correspondence of the cranio-vertebral boundaries in the different vertebrate groups. It appears that in Amniota and also in Selachii there is a long embryonal period in which only three occipital somites persist, but these very distinctly. These are the three necessary for the formation of the posterior part of the head in Selachii, and the persistence in highly developed forms, especially the Mammalia, of three occipitoblasts, is held to warrant the assumption that the two sets of structures are the same. The conclusion drawn is that they still appear in higher Vertebrates, because throughout the whole range of descent they have always been utilised in occipitalisation.

* Anat. Anzeig., xxix. (1906) pp. 185–94 (2 figs.).
† Tom. cit., pp. 91–9 (8 figs.).
‡ Op. cit., xxvii. (1905) Ergänzungsheft, pp. 111–20.

Species and Varieties: their Origin by Mutation.*—Hugo de Vries has given a luminous exposition of his discoveries and conclusions. Some of the salient features are summed up in an American review of the work.

Linnæan, or collective species, are abstract averages of a number of types. It is often necessary to segregate off from these a number of elementary species. These are contrasted with varieties in that they differ in more than one respect, and possess qualities which are distinctly new. A variety may be based on a single quality, more frequently negative than positive. Varietal characters represent physiological units, appearing and disappearing singly. In crossing varieties all the characters are paired, and the progeny follow the Mendelian law of splitting. Such crosses may be termed bisexual, to contrast them with the unisexual crosses of elementary species which result in constant hybrids. Sports originating from varieties do not introduce anything really new. The wide range of variability in "eversporting varieties" is due to the presence of mutually excluding characters, by reason of which the forms swing from one extreme to the other. In most cases, however, latency of the more or less absent character not being complete, there are intergrading forms, and thus such sports are not really new.

In his careful cultivation experiments, notably with *Œnothera lamarckiana*, de Vries found that markedly distinct forms or mutants may suddenly arise, and may continue to breed true for successive generations. These new elementary species arise abruptly without intermediate steps. New forms spring laterally from the main stem. New elementary species attain their full constancy at once; they are produced in a large number of individuals; they may occur in nearly all directions. Some new strains arising by mutation are to be ranked as variations. "The great difference between this and the Darwinian theory of the origin of species is that here we have new forms which are to be recognised as specifically distinct, arising in perfectly constant form, by sudden leaps, or more properly mutations, rather than by continuous slow variations. This, and the fact that many individuals, whole species indeed, are mutating simultaneously, must profoundly modify the Darwinian concept."

b. Histology.

Tapetum of Abramis brama.†—S. Exner and H. Januschke have studied the changes in the pigment-epithelium of the retina of this fish under different conditions of illumination. In darkness there is a definite change of shape—the thread-like or club-like processes are shortened, and their content of fuscin and guanin undergoes rearrangement. The granules of the former migrate backwards between the granules of the latter, and accumulate in the basal region of each cell.

* Species and Varieties, their Origin by Mutation. By Hugo de Vries. Edited by D. T. MacDougal. Chicago, 1905, xviii. and 847 pp. See also Review by H. M. R., Amer. Nat., xxxix. (1905) pp. 747–51.

† S.B. Akad. Wiss Wien, cxiv. (1905) pp. 693–714 (1 pl.).

The guanin granules are moved forwards. There is an intricate protoplasmic mechanism.

In darkness the cones are almost inaccessibly inclosed by the tapetum-mass, while the rods are freely exposed and have behind them the reflecting guanin-mass. The rods are the essential percipient elements in twilight vision.

In the day the cones are contracted, apposed to the membrana limitans externa, fully exposed to the light. Behind them lies the tapetum darkened with mixed pigment, which, like the chorioideal pigment in other animals, hinders the diffusion of the light, and increases localisation at the expense of intensity. The rods are unrecognisably imbedded in the opaque mass of fuscin and guanin, hardly accessible by the light. The cones are the essential percipient elements of broad daylight vision.

Histology of Optic Nerve.*—J. T. Graydon has carried out some researches on the origin and development of the epiblastic trabeculæ and the pial sheath of the optic nerve of the frog. Illustrations are also given of variations in the epiblastic trabeculæ in the developing optic nerve of mouse, chick, trout, and dogfish. It is shown that the trabeculæ are entirely epiblastic in origin, and that the nerve fibres lie, throughout the whole of their course, in the optic stalk, within the membrana limitans externa, on the outside of which the connective-tissue layer of the pial sheath is gradually formed. Three functions are performed by the cells of the optic stalk, viz.: (1) they conduct the nerve fibres, which in their turn resolve the constitution of the cells of the stalk so that they (2) provide the nerve fibres with a supporting framework, which (3) provides the whole interior of the optic nerve with an elaborate system of minute lymph channels.

Histological Changes in Pancreas.†—S. Tschassownikow has tried the effect of binding the pancreatic ducts as a contribution to the solution of the problem of the islets of Langerhans. The gland tubuli perish and the islet cells are undoubtedly preserved. There is alteration of their size and form, which is, however, dependent on the growth of the connective tissue. Further, it is asserted that the islets are incapable of being transformed into zymogen-containing elements as so many authors affirm.

Canals of Glandular Epithelium.‡—W. Rubaschkin has studied the submaxillary gland, the glands of the stomach, and the pancreas with reference to the intracellular ducts, the so-called secretory capillaries. These clear ducts are transitory variable appearances due to the coalescence of vacuoles containing fluid secretion.

Epidermis of Lepadogaster.§—F. K. Studnička describes the gland cells—"saccular serous glands" and "mucous cells"—in the epidermis of this Teleostean, and the quite unique cuticular structure of the suctorial disk.

* Quart. Journ. Micr. Sci., l. (1906) pp. 479–92 (2 pls.).
† Arch. Mikr. Anat., lxvii. (1906) pp. 758–72 (1 pl.).
‡ Anat. Anzeig., xxix. (1906) pp. 209–16 (6 figs.).
§ Tom. cit., pp. 132–44 (12 figs.).

Epithelium of Human Epididymis.*—R. Ikeda finds that both the ciliated and non-ciliated cells of the coni vasculosi are secretory; there is here no other special glandular organ. The ciliated cells arise from the non-ciliated; and at the same time the central corpuscles (diplosomes) as Benda has described, increase and grow. There is evidence that the diplosomes serve for regeneration of the cilia. The transition from vasa efferentia to vas epididymis is gradual. The cylinder cells of the vas epididymis are not genuine ciliated cells, but secreting cells; their hair-like tufts serve to conduct the secretion, and in this function it appears the contents of the nucleus share. The diplosome of the duct epithelium lies immediately under the cell surface, or rather deeper in the cell-body; between it and the tuft there is no connection. The central corpuscle is to be sought exclusively in this diplosome.

Non-Nucleated Blood Corpuscles in Vertebrates.†—C. S. Engel has found non-nucleated red blood corpuscles in the unhatched chick from the fifth to the eighteenth day, and in frog larvæ till the disappearance of the tail. In many cases in the frog the position formerly occupied by the nucleus can be distinctly seen in the corpuscle. In both bird and frog a nucleated portion can be seen connected by a protoplasmic thread with the non-nucleated portion. The non-nucleated blood cell may arise by karyolysis, or by the division of the embryonic cell into a nucleated and a non-nucleated portion.

Erythrocytes of Siredon pisciformis.‡—A. E. v. Smirnow, by using Kopsch's prolonged osmium method, has demonstrated Meves's "superficial network" and transverse threads.

Chromosomes of Lepidosiren paradoxa.§—J. A. Murray has studied these in cells of all tissues of embryos. He finds that the number is in all probability thirty-six; they form a group of variously sized elements; possibly the various sizes occur in a fixed number. The arrangement of the chromosomes in the daughter plate (and in the amphiaster) depends upon their size: the smaller lie nearer to the spindle axis than the larger.

c. General.

Vitalism.‖—Hans Driesch gives a history of vitalistic theories from Aristotle to the "neo-vitalists" of to-day, and an outline of his own doctrine. The historical part of the book has three main parts, dealing (1) with the old vitalism from Harvey and Stahl to Haller, Blumenbach, and Burdach, and thence to Johannes Müller and Liebig, Kant and Schopenhauer; (2) with the criticism of the old vitalism and the materialistic reaction, with special attention to Lotze and Claude Bernard; (3) with the new vitalism from von Hartmann onwards.

The constructive part of the book begins with a discussion of the harmony and "regulation" which are criteria of adaptive phenomena in organisms. It proceeds to demonstrate on a basis of facts the autonomy

* Anat. Anzeig., xxix. (1906) pp. 1-14, 76-81 (1 pl. and 8 figs.)
† Tom. cit., pp. 144-7. ‡ Tom. cit., pp. 236-41 (5 figs.).
§ Tom. cit., pp. 203-8 (6 figs.).
‖ Der Vitalismus als Geschichte und als Lehre, Leipzig, 1905, 246 pp.

of vital processes. It concludes with an exposition of the author's doctrine of Entelechy as a factor in Nature.

Wild Fauna of Kew.* — W. T. Thiselton-Dyer has edited an interesting volume on the wild fauna and flora of the Royal Botanic Gardens at Kew. It is very instructive to look over the census—confessedly incomplete—of the forms of life which occur, or have occurred, in this small area. They range from foxes to animalculæ, and some of them are surprising: 17 mammals, 28 songsters and many other birds, 2 reptiles, 5 amphibians, 10 fishes, 44 Gastropods, 4 bivalves, 59 Entomostraca, 6 Isopods, 10 centipedes, 13 millipedes, 39 Orthoptera, 150 Lepidoptera, many other insects, 134 spiders, 12 harvestmen, 12 water-mites, 21 exotic earthworms, 2 leeches, 120 Rotifers, 3 sponges, and 2 Protozoa. Numerous authorities have co-operated in furnishing the lists.

Adaptive Modifications of Limb Skeleton.†—R. C. Osburn reviews and discusses the various modifications in the limbs of aquatic reptiles and mammals. The groups considered especially are the Cetacea, Sirenia, Ichthyosauria, Plesiosauria, Mosasauria, Thalattosuchia, and the less modified Pinnipedia and Chelonia. The modifications which appear to be the most usual and of greatest importance in the change from the terrestrial to the natatory type of limb are:

1. Abbreviation of the limb as a whole. This is seen especially in forms with tail fin well developed, as the Cetacea and Sirenia, in which the hind limb is lost entirely, and in Ichthyosauria, some of which have the hind limb very much reduced. The shortening always begins in the proximal end of the limb.
2. Curvature or backward extension of the limb, attained in various ways—e.g. curvature of bones of limb or of digits, suppression of carpus and tarsus towards the posterior side.
3. Distal dilatation or broadening, so as to form paddles. The most common method is found in the spreading of the digits, as in all aquatic mammals, and in aquatic reptiles generally, except the Plesiosaurs and the Ichthyosaurs, where spreading of the digits is rare and slight. Also the breadth of the bones of the digits may be increased sufficiently to make this portion of the limb the widest—e.g. in Sirenia, Plesiosaurs, and some Ichthyosaurs.
4. Parallelism of fore and hind limbs. The Pinnipedia are an exception.
5. Tendency toward the loss of the hind limb. This is found almost without exception in those forms which have developed a caudal fin. In such forms the tail becomes a much more efficient propelling organ than the limbs, and the latter are of use chiefly as organs of equilibration. The anterior limbs, from their position, are naturally more useful in this respect than the posterior, and the latter tend toward reduction.
6. Tendency toward similarity in shape and function of all the bones of the limb—a degenerative process.

* Kew Bulletin, additional series 5, London, 1906, 223 pp.
† Annals New York Acad. Sci., xvi. (1906) pp. 447–82 (3 pls.).

7. Elongation of digits; hyperphalangy; hyperdactyly; formation of smaller skeletal parts.

8. Concentration of all parts except digits.

9. Cartilaginous progression in joints; loss of movable articulations in the limb; loss of tuberosities for muscle attachment.

Squamosal Bone in Tetrapodous Vertebrata.*—F. W. Thyng has investigated the homologies of the squamosal. The development of the mammalian squamosal shows it to be a membrane bone which overlies the otic capsule, and is at first intimately connected with the incus (quadrate) by a dense and fibrous stroma. It is concluded that close association with the quadrate (incus) and otic capsule is the primitive relation of the squamosal, and therefore the most important criterion in ascertaining its homology in non-mammalian Vertebrates. Juxtaposition with the parietal is a secondary relation. In Stegocephala, which probably directly or indirectly gave origin to the Mammalia, there exists not only the bone which corresponds with the squamosal as above defined, but a second bone also overlying the otic capsule between this squamosal and the parietal—that is, in the interval which, in the embryonic mammalian skull, is unoccupied by bone. Hence it seems reasonable to conclude that, in the phylogenetic development of the Mammalia, this bone, which may properly be called the supra-temporal, has been lost, and its place has been bridged secondarily by the upward development of the squamosal. No bone has been found in the temporal region of the Cæcilian skull homologous with the mammalian squamosal. The bone, so-called, is probably a post-frontal. There is a true squamosal in the Urodelan skull; it is the bone termed by Gaupp "paraquadrate." In the skulls of the Theriodontia, Anomodontia, Sauropterygia, the squamosal is the only bone which invests the temporal region. The squamosal of the most primitive reptiles, the Cotylosauria, shows practically the same relations as that of the Stegocephala. In Ichthyosaurs, the squamosal covers the dorsal external surface of the quadrate. In Sphenodon, the supra-temporal has been lost, and the bone which remains is the squamosal, its connection with the parietal being correlated with the disappearance of the supra-temporal. The single bone in the temporal region of Ophidia is the supra-temporal; there is no squamosal; crocodiles possess a true squamosal, but no supra-temporal, and so also the Dinosaurs.

Sternum and Episternum of Mammals.†—L. P. Kravetz has studied the development of the sternum and episternal apparatus in the pig and in *Mus musculus*. He concludes from these inquiries that the anamnian and amniotan sternum are homologous. The episternal apparatus sometimes develops in connection with the sternum and sometimes with the clavicle, and the question of the morphological significance of the episternum of mammals cannot be solved on the ground of development.

European Hares.‡—M. Hilzheimer gives a diagnostic table of these, with notes upon distribution. He enumerates 4 species, embracing

* Tuft's College Studies, ii. No. 2 (Scientific Series), 1906, pp. 35–73 (4 pls.).
† Bull. Soc. Imp. Nat. Sci. Moscou, xix. (1905) pp. 1–59 (2 pls.).
‡ Zool. Anzeig., xxx. (1906) pp. 510–18.

18 varieties, viz. *Lepus timidus* Linné, 4 varieties; *L. medius* Nilsson, 5 varieties; *L. europæus* Pallas, 7 varieties; *L. mediterraneus* Wagner, 2 varieties.

Abnormal Hoofs of Sheep.*—E. Warren describes and figures a remarkable hoof of a Kafir sheep. As far as could be traced, the animal was a cross between a Merino and an ordinary Kafir sheep. The hind feet only were deformed, in that the hoofs were spirally twisted. This does not appear to be altogether uncommon, but the special peculiarity in this instance is that both hoofs of a foot coil in the same direction. The slight spiral tendency in normal hoofs of a foot are in opposite directions. Further, the rudimentary hoofs of the fetlock show a distinct tendency to abnormal growth; thus the causes which produced the abnormality were effective over the whole foot.

Hands of Japanese.†—Buntaro Adachi and Yaso Adachi have made a comparative study of the skeleton of the hand in Japanese. Compared with European bones, those of Japanese are shorter in the proximo-distal direction, and relatively thicker. The articular surfaces are more strongly curved, and more extended; they are more rarely divided into two, and the adjacent surfaces are more frequently in contact. In women the articular surface is more curved and extended than in men. The basal and terminal phalanges of the fingers are (relatively to the total length) longer than in Europeans, the metacarpals and middle phalanges shorter. The terminal phalanx is more delicate and pointed. The authors seem inclined to correlate the differences of skeletal development with differences of handiwork. Comparative investigations of the skeleton in fœtuses and children have still to be made.

Angle of the Mammalian Jaw.‡—C. Toldt has made an elaborate study of the angular process of the mandible in different orders and types of mammals—in its varied forms (papilla-like, plate-like, shovel-like), proportions, and relations—with especial reference to the correlated peculiarities in the development of the masticatory muscles.

Testis of Batrachia.§—M. Nussbaum discusses various points in connection with the testis and testis-cells in Batrachia. He gives a description of this organ in *Rana fusca*, *Triton alpestris*, *T. cristata*, and *Salamandra maculata*. His main thesis concerns the problem of the influence of season and age, fasting and feeding, upon this organ, and upon the significance of mulberry-formed nuclei in its cells. In the Anura there is no part of the testis which acts as a reservoir for the rebuilding up of the rest; in the Urodela the development stages of the different divisions of the organ are such that the number of the lobes increases with the age of the animal. In fasting tadpoles (*Rana fusca*), the development of the sex-gland is markedly greater than of other parts, equal, in fact, to that of nourished larvæ. In starved adults the progress of development of the testis is arrested.

* Annals Natal Government Museum, i. (1906) pp. 109–10 (1 pl.).
† MT. Med. Facultät Univ. Tokyo, vi. (1905) pp. 349–75 (3 pls. and 1 fig.).
‡ SB. Akad. Wiss. Wien, cxiv. (1905) pp. 315–476 (3 pls. and 18 figs.).
§ Arch. Mikr. Anat., lxviii. (1906) pp. 1–121 (7 pls.).

Hermaphroditism in Frog.*—S. J. Ognew describes a case in *Rana temporaria*, and provides a summary of previously recorded cases with brief particulars regarding each. Apparently there is some relation between the sex-gland and duct in most cases. For example, on the side where the testis is developed, the oviduct is poorly so; where the oviduct is well developed the testis is slight, while the ovary scarcely reaches the normal size.

Lymphatic System of Frog Larva.†—H. Hoyer, jun., gives a clear account of the distribution of the lymph vessels in tadpoles of *Rana temporaria*, which is well illustrated in the figures accompanying the paper. The origin of this system is paired and the distribution is symmetrical; as far as known this appears to be the case in all Vertebrates.

Anatomy of Giant Salamander.‡—Albert M. Reese gives a full account of the skeleton and vascular system of *Cryptobranchus alleghenensis*.

Life-history of Cave Salamander.§—Arthur M. Banta and Waldo L. McAtee have made a study of *Sperlerpes maculicaudus* (Cope) from Carolinian caves. The larvæ are hatched and develop in the deeper fastnesses. After, and even before, transformation there is a gradual movement towards the mouth, where the adults are most numerous. The adults climb well, helped by their prehensile tails. When disturbed they can leap a foot or more at the first move. The eye is in nowise degenerate. Mating has not been observed, and the eggs have not been seen. The metamorphosis of the larvæ is described, and the development of the colour pattern.

Galvanotropism of Fishes.‖—J. Breuer has made numerous experiments, showing, for instance, that a galvanic current transverse to the head affects fishes (*Gobio fluviatilis*) in such a way that the head turns towards the anode, while trunk and tail form a concave curve towards the anode side. The trunk and tail show a similar curvature when the influence of the head is eliminated. The phenomenon depends on the direct excitation of the ganglion-cells of the spinal cord. Breuer compares what he has observed in fishes with the galvanotropism of warm-blooded animals, where the influence of the labyrinth is more marked.

Mechanism of Air-bladder in Fishes.¶—O. Thilo has experimented with carp with a view to discovering the source of the gas within the bladder. He is of opinion that it enters by the air duct, because when the bladder is emptied in an air-pump, in five hours it is again filled. On account of the small amount of blood in the fish and the sparse blood supply of the bladder, it is highly improbable that the blood is the source. Further, nitrogen is present in quantities varying from 60–80 p.c. In the blood there is only a trace of this gas. This of

* Anat. Anzeig., xxix. (1906) pp. 194–203 (1 fig.).
† Op. cit., xxvii., Ergänzungsheft, 1905, pp. 50–62 (3 figs.).
‡ Amer. Nat., xl. (1906) pp. 287-326 (14 figs.).
§ Proc. U.S. Nat. Mus., xxx. (1906) pp. 67–83 (3 pls. and 3 figs.).
‖ SB. Akad. Wiss. Wien, cxiv. (1905) pp. 27–56.
¶ Zool. Anzeig., xxx. (1906) pp. 591–604 (3 figs.).

course does not explain the case of the Physoclysti. He has not been able to demonstrate how the fishes extract the air from the water entering their mouths.

Swim-bladder of Fishes.*—E. E. Prince discusses the structure and relations of the swim-bladder in different types of fishes, and advances the view that it is a degenerate gland whose original use is gone. The interpretation of the swim-bladder as a glandular structure best accords with its character in the embryonic and larval stages. The suggestions that it is of use for helping in flotation, or in respiration, or in hearing, are dismissed as insufficiently established. It may be that the storage of nitrogen, secreted from the blood circulating in the vascular network of the swim-bladder, may be associated with states of dormancy or of inanition, or some marked change in the character of the food.

The "Oval" of the Swim-bladder.†—J. Nusbaum and Caroline Reis furnish additional evidence that disruptive changes in the cells of the epithelial body produce the gas in the swim-bladder. In *Fierasfer*, Macropods, etc., the epithelial body is an active gas-secreting gland. A study of species of *Ophidium* and *Lucioperca* shows that the so-called "oval" functions as an elastic pressure-adjusting organ. By expanding and contracting it increases or decreases the density of the gas in the swim-bladder. In *Ophidium rochii* there is an interesting mechanical device abetting this function of the oval.

Breast-bone in Cyprinus carpio.‡—W. B. von Baehr has investigated the question of the existence of a breast-bone in carp as described by Eimer. In old carp he finds an apparently cartilaginous hard formation in the position of a breast-bone, connected by several similar pieces to the bony ribs. In young carp these pseudo-skeletal parts are seen to be of the nature of connective tissue, and not cartilaginous. In *Barbus vulgaris* they are not present. In any case no real homology based on the relation to the ribs can be established; functionally, however, the pseudosternum is analogous to the sternum of higher animals.

Morphology of Teleostean Skeleton.§—D. N. Koschkaroff describes a series of typical examples of the Siluridæ. His general conclusion is that the group is undoubtedly a natural one. The question of the relationship of the family to other Teleosts is not answered, but a number of similarities between the Siluridæ and Cyprinidæ are pointed out. These are:—(1) both have a Weberian apparatus; (2) both possess a long olfactory canal; (3) in both the skull cavity is continued far forward, and ali- and orbito-sphenoid form its walls; (4) a few Cyprinoids possess a fontanelle separating the frontals similar to that of Siluroids; (5) in both the fifth segment of the skull ossifies completely and is covered above by an unpaired bone, the supra-ethmoidean. There remains the difficulty of the typical fish-scales of the Cyprinoids, which cannot be conceived as derived from the Siluroids. It is probably a case of convergence.

* Proc. and Trans. Nova Scotia Inst. Science, xl. (1906) pp. 199-226 (4 pls.).
† Bull. Internat. Acad. Sci. Cracovie, No. 10 (1905) pp. 778-84 (4 figs.).
‡ Zool. Jahrb., xxii. (1906) pp. 629-36 (1 pl.).
§ Bull. Soc. Imp. Nat. Moscou, xix. (1905) pp. 209-307 (1 pl.).

Eyes of Selachians.*—V. Franz gives an account of the physiology of the lens and iris musculature, the structure of the tapetum lucidum, of the cornea, as well as other points. The eye appears to be less essential in Selachii than in Teleosts; the well developed smelling organ and pressure system (jelly tubes) acting as compensatory. The iris musculature is not sensitive to electric stimuli; the conjunctiva functions as a membrane impervious to water, and the cornea is without an endothelium. It would appear that the ancestors of the Selachii possessed a processus falciformis which concealed the nerves and vessels of the still functioning, but now rudimentary, lens muscle.

Peculiar Group of Rays.†—V. Gratzianow describes *Brachioptera rhinoceros* g. et sp. n. from Singapore, and *Phanerocephalus ellioti* g. et sp. n. from the Indian Ocean—two peculiar forms, requiring a special group, or perhaps family (Branchiopteridæ). In the first, the foremost parts of the pectoral fins extend beyond the upturned rostrum, are hook-shaped, and turned outwards and forwards. Both surfaces of the body are quite smooth. In the second, the head is quite separate from the pectorals, which are much broader than those of *Branchioptera*. The anterior ends of the pectorals are directed forwards and somewhat inwards, and there are two large incisions between the fins and the head. There are no spines on the back or tail.

New Abyssal Fish.‡—L. Dollo describes *Neobythites brucei* sp. n., a single specimen of which was captured by the Scottish Antarctic Expedition conducted by W. S. Bruce. He distinguishes it from the only other species, *N. digittatus* Garman, and discusses the systematic position of the family Brotulidæ to which it belongs. The characters adaptive to "benthic" life are the macruriform body, the gephyrocercal tail, the lanceolate rays of the ventrals and pectorals, and the nature of the branchial spines. This new form is an interesting companion to *Bathydraco scotiæ* obtained on the same expedition.

Vascular System of Young Ammocœte.§—C. I. Cori gives a detailed account of the vascular system of the larva of *Petromyzon fluviatilis*, which, more than any other Vertebrate, displays what may be regarded as primitive and simple conditions. From what is present in the Ammocœte all the vascular arrangements in higher Vertebrates may be derived. The study of the vascular system in this type lends no support to Dohrn's view that the Cyclostomes are derivable from Selachians.

Cranial and Spinal Ganglia in Amphioxus.‖—J. B. Johnston finds that the nervous system of *Amphioxus* agrees with that of lower fishes in the following respects:—(1) It is dorsal, hollow, with separate dorsal and ventral roots, and with a brain ventricle. (2) The dorsal roots consist of general cutaneous, visceral sensory, and visceral motor components. They contain also in the head region fibres of special

* Jena Zeitschr. f. Naturwiss., n.f. xxxiv. (1906) pp. 429-69 (10 figs.).
† Zool. Anzeig., xxx. (1906) pp. 399-406 (2 figs.).
‡ Proc. R. Soc. Edinburgh, xxvi. (1906) pp. 172-81.
§ Arbeit. Zool. Inst. Univ. Wien, xvi. (1906) pp. 217-312 (3 pls. and 2 figs.).
‖ Biol. Bulletin, ix. (1905) pp. 112-27 (7 figs.).

sense-organs (olfactory or gustatory ?). (3) Both kinds of sensory fibres have ganglion cells within the cord or in the root of the nerve. (4) The two kinds of sensory fibres on entering the cord form dorsal tracts, and many cutaneous fibres show the characteristic bifurcation. (5) The viscero-motor cells are situated dorsal to the somatic motor cells, lateral to the ventral part of the canal. (6) The nerve cells retain the position and characters which are typical in the embryos of Vertebrates, and which are seen in certain parts of the brain of many fishes. (7) The ventral roots arise separately and remain independent. They are true somatic motor nerves.

Primitive conditions are undeniable, for apart from those noted under (1), (5), and (6), there is the absence of hair cells responding to vibrations in fluid (neuromasts or acustico-lateral organs) and retinal visual organs. The light-percipient organs within the central nervous system have apparently been retained from worm-like ancestors. The brain is very slightly developed.

The facts are against the theory that *Amphioxus* has degenerated from a higher type. The straightforward interpretation of the nervous system supports the view that *Amphioxus* and Cyclostomes are the lower branches of the vertebrate phylum.

Amphioxides and Amphioxus.*—R. Goldschmidt believes that *Amphioxides* may be best interpreted as a neotænic Branchiostomid larva, but that it represents the most primitive known type of Chordata.

INVERTEBRATA.

Mollusca.

South African Marine Mollusca.†—E. A. Smith gives a catalogue of South African marine Mollusca, with notes on their localities, etc. With two earlier works referred to in the paper the present list provides a complete catalogue of the known species.

γ. Gastropoda.

Re-discovery of Limax tenellus in Britain.‡—T. Petch notes that this slug, found at Durham in 1853, but afterwards excluded from the British list, was found in abundance in the pine-woods of Rothiemurchus (by Rev. R. Godfrey in 1904), and that several specimens were found in the same year by C. T. M. Plowright and the author in Epping Forest. All the British examples belong to the variety *cerea*, of a uniform waxy colour, with only faint traces of lateral banding. It has black tentacles and yellow slime, and seems to live underground until the fungi come up in autumn.

Degeneration of Tentacular Nerve of Snail.§—A. Veneziani finds that in the degeneration of the nerve fibres which follows compression of the tentacular nerve of *Helix pomatia*, the phenomena are similar to those observed in Vertebrates.

* Zool. Anzeig., xxx. (1906) pp. 443–7 (3 figs.).
† Annals Natal Government Museum, i., part 1 (1906) pp. 19–71 (2 pls.).
‡ Essex Naturalist, xlii. (1905) p. 342.
§ Anat. Anzeig., xxix. (1906) pp. 241–8 (5 figs.).

δ. Lamellibranchiata.

Structure of the Heart in Bivales.*—P. Lozinski has studied this in *Anodonta*, *Unio*, *Ostrea*, *Lima*, *Venus*, *Tapes*, *and Pecten*, and finds that there are always three distinct layers, which are described in detail: (1) a single-layer of pericardial epithelium; (2) a connective-tissue layer with isolated muscle-spindles, running parallel to the pericardial epithelium; and (3) the proper heart musculature, with bundles crossing one another in all directions. There is no cardiac endothelium.

Minute Structure of Visceral Ganglion of Anodonta.†—T. Friedenfelt describes in detail the course of the fibres in this ganglion, the fibres of the posterior pallial nerve, the commissure in the ganglion, the fibres of the cerebral connective, and the various forms of cells.

Pericardial Glands of Bivalves.‡—Henriette Boltzmann describes these in *Cyprina*, *Mya*, *Astarte*, and *Sphærium*, and corroborates Grobben's results. The pericardial gland is a specially differentiated part of the cœlomic epithelium of the pericardium, on the one hand above the auricles, on the other hand between the two mantle lamellæ. The tubules found in the second position open into the pericardium. The glandular differentiation may occur in either position or in both. The function is excretory, and closely resembles that of a kidney.

Arthropoda.

Segmentation and Phylogeny of Arthropods.§—G. H. Carpenter seeks to establish an exact numerical correspondence in segmentation between typical Crustacea, Insecta, and Arachnida. He argues from this that the Arthropods are monophyletic.

According to Carpenter, the most primitive Crustacea were nomomeristic, and the ancestors of insects and their allies must be sought far down the Crustacean stem. All the Tracheata are closely allied. It is shown that *Polyxenus*—an undoubted Diplopod—closely resembles the lowest insects and the Symphyla in the structure of its mouth-parts. The Malacopoda (Peripatidæ) occupy an isolated position, and Insects and Centipedes are much more nearly related to Crustaceans than to Peripatids. The Arachnida arose from the base of the Trilobitan branch rather than from the main Crustacean stem. Arthropods and Polychæts represent specialised collateral branches from a common stock of microscopic ancestors, unsegmented or with few segments between a broad head-lobe and a narrow tail-somite.

α. Insecta.

Degeneration of Muscles of Flight in Ants after Nuptial Flight.‖ Charles Janet notes that the relatively enormous musculature of flight, which functions only once in a life-time, disappears completely after the nuptial flight, and is replaced by columns of adipocytes.

* Bull. Internat. Acad. Sci. Cracovie, No. 1 (1905) pp. 48–62 (1 pl.).
† Acta Univ. Lund, xl. (1905, received 1906) pp. 1–28 (4 pls.).
‡ Arbeit. Zool. Inst. Univ. Wien, xvi. (1906) pp. 313–24 (1 pl.).
§ Quart. Journ. Micr. Sci., xlix. (1905) pp. 469–91 (1 pl.).
‖ Comptes Rendus, cxlii. (1906) pp. 1095–7 (2 figs.).

Spermatogenesis of Honey Bee.*—E. L. Mark and M. Copeland describe in detail certain phases in the development of the spermatocyte. They deal particularly with the bodies termed by Meves "Richtungskörper." The first of these bodies they identify as the remnants of the interzonal filaments of the previous cell-division, and term it the interzonal body. It does not appear to be comparable with the spermatocyte of ordinary spermatogenesis, and therefore not with a polar body in ovogenesis. The second body results from real (though modified) mitosis, and bears a striking resemblance to the polar cells of eggs. There appear, however, to be difficulties in the way of exact interpretation of the actual nature of either.

Wings of Tenthredinoidea.†—A. D. MacGillivray has made a detailed study of the wings of this superfamily of Hymenoptera. His elaborate memoir is a study in the phylogeny of the group based on the wings. It is an attempt to trace the course of the changes wrought by natural selection, working always towards greater efficiency of venation, an effort to apply the principles of descent to taxonomy. Classifications based on the modifications of a single organ are generally imperfect, but on no single organ of any group of animals or plants have the effects of natural selection been written so clearly as on the wings of insects. The record is spread out as on a printed page, and only awaits its translator. The author has given us the translation of the history written on the wings of the Tenthredinoidea.

Moth Parasitic on a Sloth.‡—Arnold Spuler describes *Bradypodicola hahneli* g. et sp. n., an interesting moth, probably referable to a new sub-family within the Galleriinæ, which, according to Hahnel, lives as an ectoparasite on the skin of *Bradypus*,—a unique mode of life to which the form of the body, the limbs, and other features are adapted.

Development of Catocala nupta.§—J. Hirschler has studied the early stages in the development of this moth, with especial reference to the origin of the mesenteron. This seems to arise from two sources: its anterior and posterior portions develop from ectodermic lamellæ, its median portion is due to "blood-cells," or secondary endoderm-cells. The processes which lead to the formation of the lower layer represent a disguised gastrulation. The lower layer is the primary endoderm, which is differentiated into a median strand of vesicular cells (the secondary endoderm), and two lateral portions (the mesoderm).

Species of Elateridæ.‖—E. Reitter gives a diagnostic key to the species of the family Elateridæ. Accompanying this is a review of the characters of all the related families and sub-families comprehended under the division Sternoxia of the Coleoptera.

Myiasis of Toads.¶—E. Hesse describes three cases of *Bufo vulgaris* infected with dipterous larvæ. Klunzinger has already noted two

* Proc. Amer. Acad., xlii. (1906) pp. 103–11 (1 pl.).
† Proc. U.S. National Museum, xxix. (1906) pp. 569–654 (24 pls.).
‡ Biol. Centralbl., xxvi. (1906) pp. 690–7 (7 figs.).
§ Bull. Internat. Acad. Sci. Cracovie, x. (1905) pp. 802–10 (4 figs.).
‖ Verh. naturf. Ver. Brünn, xliii. (1904) pp. 3–122.
¶ Biol. Centralbl., xxvi. (1906) pp. 633–40 (1 pl.).

similar cases. The larvæ, which are able to destroy their host in a few days, were hatched by Hesse and identified by E. Girschner as those of *Lucilia splendida* Zett. and Meig.

Ravages of Exotic Fruit-fly near Paris.*— A. Giard noted in 1900 the occurrence of an exotic fly, *Ceratites capitata* Wied., near Paris. Since then, no precautions having been taken, the insect has continued its insidious work, and in some localities has been seriously affecting the peach crop.

Habits of Tsetse-Flies.†—F. Creighton Wellman has studied *Glossina palpalis wellmani* Austen in the Esupua "fly-belt." The district contains various antelopes, but human blood forms the greater part of the tsetse-fly's food. The flies hide in the tall grasses and sedges near the river, also on stones, trunks of trees, vines, and bushes. When a native appears the flies follow him. Some were seen in the "desert" bush away from the river. The fly bites most viciously during the heat of the day, less readily in the evening and early morning.

Cause of "Markflecke."—J. C. Nielsen‡ has made a zoological study of the "Markflecke"—linear or semilunar spots seen on the annual rings of wood in birch, hazel, and other trees. He finds that they are due to the larvæ of a fly *Agromyza carbonaria* Zett. whose life-history he has been able to work out.

Habits and Structure of Gall-midge.§—M. Leitner gives an account of *Resseliella piceæ*, a new Cecidomyid. The time of flight and oviposition coincides with the fructification of the fir. The eggs are laid between the still fleshy tender seed-scales, the larvæ burrow into the soft ovule, upon whose contents they are nourished. The larva leaves the seed either before the winter or in the following spring, and lives upon the ground. The complete cycle of development occupies two years, an adaptation related to the fertilisation of the fir which occurs every second year. A description of the larva, pupa, and imago stages is given.

Antennal Sense Organs in Diptera.‖—E. Röhler describes in *Volucella bombylans* on the club-like segment of the antenna a double pit. In other species three pits occur. From analogy he concludes these organs possess an olfactory function. There are pale hairs on the same segment with a like function. In general it appears that all the antennary sense organs are similar in Brachyceræ.

Dragon-flies in Brackish Water.¶—Raymond C. Osborn has experimented on the extent to which dragon-fly nymphs can endure brackish water. In ponds in which nymphs were found the average density was about 1·0008 at a temperature of 72° Fahr. Sea-water has an average density of 1·026. Nymphs of *Lestes unguiculatus* and other forms were

* Comptes Rendus, cxliii. (1906) pp. 353–4.
† Ann. Nat. Hist., xviii. (1906) pp. 242–4.
‡ Zool. Jahrb., xxiii. (1906) pp. 725–38 (1 pl.).
§ Verh. k.k. Zool. Bot. Ges. Wien, lvi. (1906) pp. 174 86 (5 figs.).
‖ Zool. Anzeig., xxx. (1906) pp. 211–19 (6 figs.).
¶ Amer. Nat., xl. (1906) pp. 395–9.

placed in water up to about 1·003, and showed no ill effects. Some became inured to 1·005, 1·0075, and 1·01; but higher solutions were always fatal. Eggs were hatched in 1·01 and weaker solutions, and developed normally and at the normal rate, but the larvæ showed no increased power of resistance. There is therefore a very definite barrier to the assumption of marine life, and the barrier remains unchanged during the life of the individual.

Permian Odonata.*—E. H. Sellards discusses the Odonata found in the Permian of Kansas, which is the most complete record of Permian insect life as yet known. Over two thousand specimens have been obtained, showing that the Permian insect fauna was very rich. In discussing the Odonata obtained for the first time from the Permian, the author devotes his attention particularly to a new type which he calls *Tupus permianus*. He shows that the main veins of the wings in Carboniferous and Permian dragon-flies present an arrangement in agreement as regards major characters with that of both Mesozoic and modern forms.

Stridulation of Gryllus campestris.†—Alois Kreidl and Johann Regen have investigated with the help of the phonograph the number of vibrations in the stridulation-note. They have estimated the number of times per minute that the wing surfaces are rubbed against one another, and have made a careful study of the details of the complex instrument.

Spermatogenesis in Locusta viridissima.‡—H. Otte finds that all the chromosomes change in the young spermatocytes into filaments, which become longitudinally apposed to form bivalent double-filaments. These are twice divided transversely. There is a single accessory chromosome, the simple univalent-filament of which is divided once transversely in the second maturation division. Thus in the two transverse divisions there is no proper reduction (in Weismann's sense), since no entire chromosomes are separated from one another. The two chromosomes which conjugate to form a single bivalent chromatin element are twice halved transversely, but they do not part company.

Notes on Machilidæ.§—F. Silvestri describes a new genus *Allomachilis*, allied to *Machiloides*, represented by *A. frogatti* sp. n. from New South Wales. Five other new species are described, and the author makes various notes on the family, and gives a diagnostic key to the genus *Machilis*.

Key to Families and Genera of Thysanura.‖—C. F. Jackson has prepared a useful diagnostic key to this order of insects, based on Dalla Torre's monograph.

Injurious Insects of the State of New York.¶—E. P. Felt discusses a number of injurious insects, e.g., the grape-root worm (*Fidia*

* Amer. Journ. Sci., xxii. (1906) pp. 249–58 (8 figs.).
† SB. Akad. Wiss. Wien. cxiv. (1905) pp. 57–81 (1 pl.).
‡ Zool. Anzeig., xxx. (1906) pp. 529–35 (14 figs.).
§ Redia, iii. (1905) pp. 325–39 (13 figs.).
‖ Ohio Naturalist, vi. (1906) pp. 545–9 (7 figs.).
¶ New York State Museum, Bulletin 104, Entomology 26, Albany, 1906, pp. 49–156 (10 pls.).

viticola), the army worm (*Heliophila unipunctata*), the grass web-worms (*Crambus*), the San José scale (*Aspidiotus perniciosus*).

He also * gives a full and beautifully illustrated account of the gipsy moth (*Porthetria dispar*), a notorious pest, and of the more recently introduced brown tail moth (*Euproctis chrysorrhœa*), which threatens to develop into a serious enemy of fruit, shade, and certain forest trees.

Flower-visiting Insects in Styria.† — Karl Fritsch has collected, and communicates particulars regarding the visits of insects to 150 species of plants. The observations were made in the neighbourhood of Graz, during six months from April to October.

δ. Arachnida.

Collections of Spiders.‡—H. Desmaisons finds that spiders collected for museum purposes are best killed in ether, and fixed on glass slides with strong gum-arabic. When the gum is dry, the specimen should be placed in 90 p.c. alcohol. The webs should be represented by photographs, and a gentle spraying of the web with a vaporiser is useful before the photograph is taken. A good example of the results of this method is given in the accompanying plate.

Gland System in Ixodes.§—E. Nordenskiöld describes in *Ixodes* in females after egg-laying, or a week after sucking blood, a peculiar gland, which does not occur in immature forms. It is, histologically, quite unlike other glandular structures of *Ixodes*, but resembles the skin-glands of butterfly caterpillars. It is paired, and consists of a single very large cell situated on the anterior part of the body cavity, right and left of the mouth-parts. It is much branched, and possesses a giant-branched nucleus. There is an intra-cellular canal system, whose walls are lined by small rods. The secretion is granular, and is poured into the canals in the form of balloon-shaped little drops.

Resisting Powers of Tyroglyphinæ.‖—A. Maurizio concludes an account of the mode of life of these mites, with a description of numerous exceedingly careful experiments as to their astonishing power of resisting poisons and destructive reagents.

ε. Crustacea.

Coral-infesting Crab.¶— J. R. Henderson describes *Cryptochirus dimorphus* sp. n., an interesting form discovered by Major A. R. Anderson at the Andaman Islands. Like others of the same family (Hapalocarcinidæ), this crab takes up its abode as a commensal in living corals, and causes abnormal growth, which results in forming a partially closed chamber or prison. The new species exhibits very striking sexual dimorphism. The dwarfed male, which is less than one-fourth the size of the female, has a total length of 1·25 mm., probably a record for diminutive size among adult Decapods. Another unique peculiarity of

* New York State Museum, Bulletin 103, Entomology 25, pp. 1–20 (10 pls.).
† Verh. k.k. Zool. Bot. Ges. Wien, lvi. (1906) pp. 135–60.
‡ Bull. Soc. Linn. du Nord de la France, xvii. (1904) received 1906, pp. 107–10 (1 pl.).
§ Zool. Anzeig., xxx. (1906) pp. 484–5.
‖ Centralbl. Bakt. Parasitenk., 2te Abt., xv. (1906) pp. 723–36.
¶ Ann. Nat. Hist., xviii. (1906) pp. 211–19 (1 pl.).

the male is his habit of attaching himself to the ventral surface of the female. A careful description of both sexes is given, and the species is distinguished from *C. coralliodytes* Heller.

Malacostraca of the Gulf of Odessa.*—M. Kalichewsky gives an account of the higher Crustacea of the Gulf of Odessa. The report, which is in Russian, deals with thirty-seven species, including *Amphithöe buczinskii* sp. n., one of the Podoceridæ.

Development and Systematic Position of Nebalia.†—Margaret Robinson has studied a series of stages of *Nebalia*. She concludes that the history of development confirms Claus's view as to the Malacostracan position of this form. One feature in the development of *Nebalia* in favour of this position to which attention is drawn, is the sharpness of definition with which the embryonic stages are marked off from one another. *Nebalia* appears to be most nearly related to *Mysis*; this view is supported by the fact that organs which are similar in the adult are alike also in their development. For example, the brood pouches in the two animals are formed in the same way by spiny outgrowths on the coxopodites of the thoracic legs. Other points in common are the peculiar form of gastrulation, the development of the endoderm, the subsequent formation of the midgut by circumcrescence, and the development of the liver lobes, heart, and brain. It seems not improbable that *Nebalia* is the most ancient living Crustacean at present known.

New Operculate Cirriped.‡—A. Gruvel describes *Pyrgopsis annandalei* g. et sp. n., a new Indian type allied to *Pyrgoma*, but with a membranous base (without calcareous envelope) and with a stalk suggestive of the pedunculate forms.

Hermaphroditism of Male Apus.§—N. von Zograf has found distinct ova lying free in the testes of a male *Lepidurus productus*. Similar phenomena have been recorded by Nebesky for *Orchestia cavimana* and by La Valette St. George for *Astacus*. H. M. Bernard has noted physiological as well as morphological hermaphroditism in *Lepidurus glacialis*.

Parasitic Copepod in Amphiura squamata.‖—E. Hérouard has found in the incubatory sac of this Ophiuroid a remarkable female Copepod whose appendages are in part modified into long bow-like structures. These help to dilate the sac. Hérouard found 1–4 pigmy males of triangular form fixed by hooks to the abdomen of the female. The female resembles *Philichthys scienæ* Richardi, but the male is very different, being triangular and unsegmented instead of being rectilinear and distinctly segmented. But the author thinks this new endoparasite may be named *Philichthys amphiuræ* sp. n.

New Genus of Gymnoplea from Natal.¶—A. W. Cooper describes *Adiaptomus natalensis* (g. et sp. n.) whose most distinctive character

* Mem. Soc. Nat. Nuov. Russie, xxix. (1906) pp. 1–34 (2 pls.).
† Quart. Journ. Micr. Sci. l. (1906) pp. 383–433 (6 pls.).
‡ Comptes Rendus, cxlii. (1906) pp. 1558–9.
§ Zool. Anzeig., xxx. (1906) pp. 563–7 (3 figs.).
‖ Comptes Rendus, cxlii. (1906) pp. 1287–9 (3 figs.).
¶ Annals Natal Government Museum, i. (1906) pp. 97–104 (1 pl.).

is that both antennæ in the female and the left in the male have twenty-six joints, and the right in the male twenty-three. No other member of the Gymnoplea is known with more than twenty-five.

Oogenesis and Spermatogenesis in Cyclops strenuus.*—P. Lerat finds that the general sequence of kinetic processes is the same in oogenesis and spermatogenesis. The only noteworthy difference is in the volume of the cells. In the zone of multiplication all the cells have the normal number of chromosomes. The numerical reduction does not precede the first maturation-division. During the period of synapsis, the chromatin forms filaments which unite in pairs to form a thick spireme and are afterwards separated in an apparent longitudinal division. The maturation divisions are the same in the two sexes. The first division is heterotypic: there is a true longitudinal cleavage of the chromosomes; the second division is homotypic; and in the heterotypic division the numerical reduction of chromosomes is effected.

Annulata.

Bionomics of Annelids.†—G. Bohn gives an account of the behaviour and general functions of Annelids. In a preliminary section he deals with the organisation and functions of the organs, discussing a typical segment, differentiation of segments, different regions of the body, and variations in the number of segments. The next section treats of the classification, which, it is pointed out, is an ethological one; the bathymetric distribution of marine Annelids; the different habitats—rock, sand, mud, etc.; and the different modes of life, tubicolous, commensal, etc. Then follows a consideration of the different families, under which, in all, seventy-three species are dealt with as regards their habitats and mode of life.

Embryology and Affinities of Sipunculidæ.‡—J. H. Gerould gives a very full account of the development of *Phascolosoma* from maturation and fertilisation on to post-larval stages. The paper includes also a comparison with *Sipunculus*, Chætopods, Echiurids, Molluscs, and Vermidea, and also a statement of the generic characters of *Sipunculus* and of *Phascolosoma*. It is concluded that the Sipunculids are probably primitive forms. This is shown by their unpaired, unsegmented, ventral nerve-cord, by the retention in the adult of the principal retractor muscles of the trochophore, and of the single pair of thoracic nephridia. The entire organisation of the adult is exceedingly simple and trochophore-like. The transitory metamerism of the trochophore of *P. gouldii* probably indicates a near relationship to that type, an incipient tendency towards metamerism. Sipunculids are Annelids closely allied to the Chætopods and to primitive Molluscs, but are even simpler in structure than the Archiannelida.

Larva of Echiurus.§—W. Salensky gives an account of the structure of this larva, dealing with its externals, ectoderm layer, and skin

* La Cellule, xxii. (1905) pp. 163–99 (4 pls.).
† Ann. Sci. Nat. (Zool.) iii. (1906) pp. 35–144.
‡ Zool. Jahrb. Abt. Anat, xxiii. (1906) pp. 77–162 (8 pls. and 4 figs.).
§ Mém. Acad. Imper. Sci. St. Pétersbourg, series 8, Classe Physico-Mathématique, xvi. (1905) pp. 1–102 (10 pls.).

glands, the ciliated rings, the ectoderm of the intertrochal zone, nervous system, gut, mesodermal structures including cœlome, and nephridia. There are comparative notes on other Echiuridæ. *Echiurus* and *Thalassema* are closely related by several important characters: they are distinct from the Annelids. If placed amongst Annelids they must stand in an isolated group.

Cirrus and Elytron in Aphroditidæ.*—H. Duncker has set himself the problem of settling the question of homology between these two structures in this family, and fills 140 pages with the record of his investigations. On histological and topographical grounds he concludes they are homologous. Normally they always exclude each other, and are the only innervated organs of the parapodium.

New Species of Oligochæta.†—L. Cognetti de Martiis describes the following new forms—*Pheretima habereri*, *Ph. marenzelleri*, *Ph. ambigua*, *Tritogenia morosa*.

Nematohelminthes.

Conditions of Development in Ascaris vitulorum.‡—L. Jammes and A. Martin find that the receptivity of the host depends in the first place on its temperature. The nature of the digestive fluids is also important; the succession of an acid and an alkaline medium is favourable to development. Susceptibility to parasitism varies with age and physiological condition. It is suggested that the development of the parasites is in some measure conditioned by pre-existing abnormal conditions in the host.

Maturation in Ascaris canis.§—H. Marcus has studied the egg and sperm maturation in this species of *Ascaris*. The following are the more important of his results. He finds that conjugation of the chromosomes takes place. Both maturation divisions are longitudinal, consequently one must be a genuine reduction division. The chromosomes show a "Duplicität." In the original sex-cells, a reduction of the number appears again to occur through "Konjunktion" of the chromosomes; a symmixis is therefore probable. On the ground of far-reaching "Gonomery" inside the chromosomes both maturation divisions can be regarded as reduction divisions. The centrosome arises in the nucleus; probably the centrosome of the spermatid persists and enters the egg in the nucleus of the spermatozoon.

Oxyuris in Vermiform Appendix.‖—H. Schöppler describes a case in which a string of eggs of *Oxyuris vermicularis* occurred in the vermiform appendix of a child. The eggs were arranged exactly as they lie within the parent worm, and had undergone partial development. It is suggested that the worm, having migrated to the appendix, underwent maceration, but that the eggs, on account of their more resistant coverings, had withstood this process.

* Zeitschr. Wiss. Zool., lxxxi. (1906) pp. 191–342 (1 pl. and 33 figs.).
† Atti R. Accad. Sci. Torino, xli. (1906) pp. 777–90 (1 pl.).
‡ Comptes Rendus, cxliii. (1906) pp. 189–90.
§ Arch. Mikr. Anat, lxviii. (1906) pp. 441–90 (2 pls. and 10 figs.).
‖ Centralbl. Bakt. Parasitenk., xli. (1906) pp. 453–5 (1 fig.).

Species of Strongylus in Gibbon.*—H. Smidt in the course of examination of forty gibbons (*Hylobates syndactylus* and *H. agilis*) found several instances of severe affection of the large intestine. This proved to be due to the presence of *Strongylus ovatus* v. Linstow, which was found in various situations. Particulars with regard both to the parasite and to the lesions produced are given.

Structure of Mermis albicans, v. Sieb.†—Max Rauther, in the first of a series of studies on the structure of Nematodes, describes some of the macroscopic and microscopic features of this species. He deals specially with the ectodermal organs—the skin, the neuro-muscular system, certain parts of the alimentary canal, viz. œsophagus and cloaca. The mid-gut, which is transformed into a holder of reserve-stuffs, and the genital apparatus are only slightly dealt with.

New Nematodes and other Parasites.‡—O. von Linstow describes the following Nematodes—*Ascaris sphyranuræ* sp. n. from the body-cavity of *Sphyranura barracuda*; *A. halicoris* Baird, from the pylorus of the dugong; *Filaria macrolaimus* sp. n. from the orbit of *Centrurus subelegans*; *Trichocephalus alcocki* sp. n. from the stomach of *Cervus eldi*; *Rhabditis tripartita*, from a monkey. He discusses the life-history of *Parachordodes tolosanus*, and also describes *Hemistomum attenuatum* sp. n. from *Buteo vulgaris*, *Holostomum excisum* from *Aegolius otus* and *Strix flammea*, and *Hymenolepis inflata* Rud. from the coot.

Platyhelminthes.

Tæniæ of Birds of Prey.§—O. Fuhrmann describes four forms. He notes that the birds of prey of America harbour a quite special Tænia-fauna, whilst none of the known Tæniæ occurring in European-Asiatic-African birds of prey are found in American representatives of the same group. Another interesting point is that day and night birds of prey, though in many cases they have the same food, are the hosts of quite different Tæniæ. In the one group fifteen species are known, and in the other, two. The latter belong to one genus (*Paruterina*), the representatives of which live only in nocturnal birds of prey.

Studies on Tapeworms.‖—O. Fuhrmann continues his study of the Cestodes of birds of prey, and describes *Anomotænia trapezoides* sp. n.; *Paruterina angustata* g. et sp. n. (with a "paruterine" diverticulum in front of the uterus into which the ova pass at a late stage); *Dilepis oligorchida* sp. n.; *Oligorchis strangulatus* g. et sp. n. (near *Hymenolepis*, but with four testes instead of three); *Dipylidium avicola* sp. n.; and *Tænia heteracantha* sp. n.

J. Bourquin ¶ describes *Davainea latoralis* sp. n. from *Galeopithecus volans*, which has a "ciliform" cuticular investment over almost the whole surface of the scolex, with the exception of the suckers.

* Centralbl. Bakt. Parasitenk., xli. (1906) pp. 646–51 (4 figs.).
† Zool. Jahrb., xxiii. (1906) pp. 1–76 (3 pls.).
‡ Op. cit., xxiv. (1906), pp. 1–20 (1 pl.).
§ Centralbl. Bakt. Parasitenk., 1te Abt., xli. (1906) pp. 79–89 (32 figs.).
‖ Tom. cit., pp. 212–21 (17 figs.).
¶ Tom. cit., p. 222.

Motility of the Echinococcus Scolex.*—J. Sabrazès, L. Muratet, and P. Husnot have tried to throw some light on the secondary metamorphosis which occurs when a cyst of *Echinococcus* is ruptured. They have found that minute scolices in a drop of the fluid at a temperature of 31° C. exhibit considerable though slow motility. It seems not unlikely that they can migrate actively in the tissues of the infected subject if they are liberated from the cyst.

Mammalian Cestodes.†—C. v. Janicki has examined 28 species, chiefly from the collections of the Berlin and Vienna Museums. Sixteen of the species are described as new. From Didelphidæ there is a new form of the genus *Linstowia* Schokke, occurring exclusively in aplacental mammals. Representatives of the old genus *Oochoristica* Lühe are met with in two species (one of which is new) for the first time in Marsupials. Previous accounts of other forms are added to with reference to several structural points, and new species are described.

Polyonchobothrium polypteri Leydig.‡—B. Klaptocz re-describes this species. It is one of the Bothriocephalidæ—Lühe's sub-family Ptychobothriinæ. Its most noteworthy peculiarity is that it is the only species in this group possessing hooks. They occur upon the lobes of the scolex in its distal and most mobile region. An amended diagnosis of the genus *Polyonchobothrium* Diesing, is given.

Schistosoma japonicum in the Philippines.§—P. G. Woolley has found in lesions of the lungs, liver, and bowel of a Filipino, ova which agree in shape, size, and colour with those of *Schistosoma japonicum* vel *cattoi*. It seems, then, that this blood-fluke occurs not only in China and Japan, but also in the Philippine Islands.

Studies on Turbellaria.‖—W. A. Haswell describes *Heterochærus australis* g. et sp. n., an "acœlous" Turbellarian with some peculiarities—e.g. the absence of a "frontal organ." The sub-ordinal name Acœla is not strictly applicable, since an enteric cavity, of a sort, is present. The reproductive apparatus is entirely absent during the winter. There are symbiotic algæ with distinct cell-walls.

The author also describes *Anomalocœlus cæcus*, a new type of Rhabdocœle, outside the limits of all the known families. The arrangement of the male ducts (with the vesicula seminalis and prostate reservoir both inclosed in the penis sheath) is very exceptional, occurring elsewhere only in the Vorticida, from all of which the new form is distinguished by having diffuse or follicular testes, and by having a pharynx rosulatus instead of a pharynx doliiformis. There is one reproductive aperture and a single ovary; the uterus is combined with the genital atrium; there are reticulate vitelline glands; the penis is armed with numerous chitinous teeth; the intestine is devoid of a definite layer of epithelium.

* Comptes Rendus, cxlii. (1906) pp. 1353-5.
† Zeitschr. wiss. Zool., lxxxi. (1906) pp. 505–97 (6 pls. and 15 figs.).
‡ Centralbl. Bakt. Parasitenk., xli. (1906) pp. 527–36.
§ Philippine Journ. Sci., i. (1906) pp. 83–9 (3 pls.).
‖ Quart. Journ. Micr. Sci., xlix. (1905) pp. 425-67 (3 pls.).

Notes on Convoluta roscoffensis Graff.*—E. Warren has made the interesting discovery of the presence of *Convoluta roscoffensis* at Scottsburg, on the Natal coast. They have been found occupying an area of a few hundred yards only, and have not been discovered, though looked for, elsewhere. On the circumscribed area they were present in large numbers, giving the sand a bright green tint. Some observations have been made upon the ova, which, during their growth and maturation, are remarkable for their branched or stellate condition—they are probably sending out pseudopodia into the surrounding parenchyma, for there are no follicle cells.

Triclad Studies.†—L. Böhmig gives a systematic and anatomical account of the families Procerodidæ and Bdellouridæ. This embraces diagnostic descriptions of the families, sub-families, genera, and species, with lists of synonyms, so that there is a satisfactory clearing of the ground in this field. The anatomical account is also comprehensive; the nervous system (including sense organs) and the genital system in particular are exhaustively discussed.

Fresh-water Species of Polycystis. ‡ — E. Bresslau describes *Polycystis goettii* sp. n. from a pond in the botanic garden at Strassburg. It is particularly interesting as being, like Du Plessis' *Macrorhynchus* (*Phonorhynchus*) *lemanus*, a fresh-water representative of a marine genus.

Maturation and Fertilisation in Thysanozoon brocchi.§ — R. Schockaert describes the origin of the male pronucleus and the appearance of a peculiar transient "spermocentre." As the female pronucleus is formed, the ovocentre disappears. The centrosomes of the first cleavage seem to be new formations, and so do those of the second and third cleavage.

Nervous and Excretory Systems of Freshwater Triclads.‖ — H. Micoletzky describes in species of *Planaria*, *Polycelis*, etc. the minute structure of the "brain," which is composed of three pairs of ganglia with three commissures, and the general structure of the excretory canals.

Bathypelagic Nemertines.¶—L. Joubin calls attention to ten new species of bathypelagic Nemertines collected by the Prince of Monaco off the Azores and Canaries and in the Sargasso sea. There are six new species of *Planktonemertes*, three of *Nectonemertes*, and one of *Pelagonemertes*, the descriptions of which will be published later.

Incertæ Sedis.

Ordovician and Silurian Bryozoa.**—Ray S. Bassler has revised the large collection made by U. P. James and described by him and his son,

* Annals Natal Government Museum, i. (1906) pp. 105–8 (1 pl.).
† Zeitschr. wiss. Zool., lxxxi. (1906) pp. 344–504 (8 pls. and 9 figs.).
‡ Zool. Anzeig., xxx. (1906) pp. 415–22 (5 figs.).
§ La Cellule, xxii. (1905) pp. 1–37 (3 pls.).
‖ Zool. Anzeig., xxx. (1906) pp. 702–10 (4 figs.).
¶ Comptes Rendus, cxlii. (1906) pp. 1349–51.
** Proc. U.S. Nat. Mus., xxx. (1906) pp. 1–66 (7 pls.).

J. F. James. He has endeavoured to correct and deepen the diagnoses, and to adjust the nomenclature.

Development of Flustrella hispida (Fabricius).*—R. M. Pace has investigated the earlier stages, and gives an account of the eggs, spermatogenesis and oogenesis, maturation, segmentation to the 32-celled stage, etc. The main results obtained are the following. There is a "yolk-nucleus" in the egg. The formation of the endoderm has been traced. The oral and aboral ectoderm are differentiated as early as the 16-celled stage and remain quite distinct from that time onward. The ciliated ring of the larva is formed by the coalescence of several originally distinct rows of cells, and not by the hypertrophy of a single row. A stomach comparable to that of *Alcyonidium* is present also in *Flustrella.*

Brachiopods of the Valdivia and Gauss Expeditions.†—F. Blochmann makes a preliminary report on new species from the far south—*Liothyrina antarctica*, *L. winteri*, *Chlidonophora chuni* (with a relatively long stalk with a brush-like lower end adapted for fixation in the loose *Globigerina* ooze), ***Macandrevia vanhöffeni***, ***Magellania joubini***, and ***Terebratella enzenspergeri***.

Norwegian Actinotrocha and the Affinities of Phoronis.‡—A. Schepotieff describes two forms of Actinotrocha from Norway, and discusses briefly the affinities of *Phoronis*, which on account not of the structure of the larva only, but of the whole organisation is to be placed near the Phylactolæmata (Bryozoa) on the one side and the Pterobranchiæ on the other. It thus belongs to the oligomere forms which, on account of their connections with the Pterobranchiæ, are all related, and form a group of the Triarticulata (Schimkewitsch, 1892), as follows :—

Oligomere forms.	typical Triarticulata		Enteropneusta
			Pterobranchia
	modified Triarticulata	with epistome	Phoronidea
			Ectoprocta
		with shell	Brachiopoda

Near the oligomeres but not related to each other are on one side the Chætognatha and on the other the Endoprocta. In all cases where development is known the structure of the free-swimming larvæ may be referred to the general type of the trochophore. The Actinotrocha deviates considerably from this type in the presence of the tentacle crown.

Rotatoria.

Rotifera from Indo-China, Sumatra and Java, etc.§—E. T. Weber, having examined some tubes of plankton material collected in these countries by Walter Volz, gives lists of the Rotifera found in these gatherings, some 25 species in all. The author describes and figures in the text some of the more remarkable forms found in these

* Quart. Journ. Micr. Sci., No. 199 (1906) pp. 435–78 (4 pls.)
† Zool. Anzeig., xxx. (1906) pp. 690–702 (3 figs.).
‡ Zeitschr. wiss. Zool., lxxxiv. (1906) pp. 79–94 (2 pls.).
§ Zool. Jahrb., xxiv. (1906) pp. 207–226.

localities, among which may be mentioned the following:—*Brachionus falcatus* Zach., showing numerous variations, and *Metopidia* (*Notogonia*) *Ehrenbergi* Perty, both from Java; *Polychætus Collinsii* Gosse and *Brachionus militaris* Ehrbg., from Cochin-China; *Euchlanis plicata* Levander, from the Sandwich Islands. No new species were found.

Echinoderma.

Peculiar Larval Asterid.*—R. Koehler and C. Vaney describe under the name *Stellosphæra mirabilis* a peculiar larval Asterid, obtained by the Prince of Monaco from a depth of 2000–3000 metres off the Azores. It is unlike any known pelagic form, but its pedicellariæ are like those of star-fishes of the Forcipulæ group. It is very probably the larva of an abyssal form. The body is almost spherical, about 3 mm. in diameter, with superficial sharp calcareous corpuscles arranged in groups and inserted on calcareous plates, with an internal enteron showing two coils and two œsophageal diverticula. At a later stage the corpuscles and plates are absorbed. A six-rayed symmetry indicated by six equatorial plates persists after these disappear. The secondary plates of the aboral poles show a five-rayed arrangement. The presence of two buccal tentacles indicates bilateral symmetry.

First Recorded Occurrence of Blastoidea in New South Wales.† T. Griffith Taylor describes from Carboniferous beds at Clarencetown the first Blastoid found in New South Wales. It is noteworthy for its large size, the calyx probably measuring 7–8 cm. when intact. It is one of the Troostoblastidæ and agrees most closely with *Metablastus*.

New Brood-nursing Synaptid.‡—S. Becher gives an account of *Synapta minuta* sp. n. It is a brood-nursing species, of which fourteen are now known. In the present species the body-cavity is used as brood chamber. A consideration of the contractile rosette of the Holothuriæ is included in the paper, the author concluding, contrary to the views of earlier writers, that it is an adult and not simply a larval structure.

Cœlentera.

Reactions of Tubularia crocea.§—A. S. Pearse has made a number of experiments on this hydroid. The proximal tentacles react to mechanical stimulation by bending towards the manubrium. The distal tentacles react to mechanical and chemical stimulation by bending towards or away from the mouth, and this action may be accompanied by a bending of the manubrium towards the stimulated side. Apparently no part of the hydranth is sensitive to very dilute solutions of meat juice, onion juice, or oil-of-cloves. The minimum temperature at which reactions occur is 0° C., and the maximum about 26° C. Sudden change from strong light to shadow or from darkness to strong light has no apparent effect upon the animals.

* Comptes Rendus, cxlii. (1906) pp. 520–2.
† Proc. Linn. Soc. N.S.W. xxxi. (1906) pp 54–9 (4 figs.).
‡ Zool. Anzeig., xxx. (1907) pp. 505–9 (3 figs.).
§ Amer. Nat., xl. (1906) pp. 401–7 (1 fig.).

New Natal Hydroids.*—E. Warren describes *Halocordyle cooperi* sp. n., whose special characters appear to be the capitate tentacles which tend to be arranged in whorls and adelocodonic gonophores. Another new form dealt with is *Tubularia solitaria* sp. n., which appears to have affinities with *Corymorpha* and with *Tubularia*, agreeing with the former in the trophosome characters and with the latter in the nature of the gonosome. The presence of an actinula has decided its inclusion amongst the Tubulariæ.

Behaviour of Sea Anemones.†—H. S. Jennings has studied the modifiability of behaviour in sea anemones, but only an abstract of his researches is given. Changes in the internal physiological processes, former stimuli that have affected the animal, former reactions performed, and other factors combine to determine an action. There is a marked tendency in some cases to repeat an action in the way it has been performed before. These various factors give a high degree of complexity and adaptiveness to the behaviour of even these low animals.

Madreporaria Collected by the "Albatross."—T. Wayland Vaughan‡ reports on a small collection from the Eastern Tropical Pacific, which includes the following new forms: *Desmophyllum galapagense*, *Madrepora galapagensis*, *Pocillopora diomedeæ*, *Bathyactis marenzelleri*, *Balanophyllia galapagensis*, four species of *Acropora*, and *Porites paschalensis*. These are all beautifully figured. The author calls attention to the meagreness of our knowledge of the deep-sea Madreporaria of the greater part of the Pacific Ocean.

Septa of Rugosa.§—J. E. Duerden finds that the Rugose corals and the Zoanthid Actinians have both a primary hexamerism. The septa in the Rugosa and the mesenteries in the Zoantheæ are added in bilateral pairs at only one region, a vertical zone within the primary exocœles, there being four such regions—middle and ventro-lateral chambers—in the Rugosa, and two—ventro-lateral chambers—in the Zoantheæ.

The septa in the Rugosa and the mesenteries in the Zoantheæ are never polycyclic, as in modern corals and ordinary Actinians; at most there are only two cycles of septa, large entosepta and small exosepta, disposed in such a manner as could only have been produced in polyps with a mesenterial arrangement similar to that of the Zoantheæ.

The presence of a ventral directive fossula in the Rugosa, usually persisting in the fully developed and otherwise perfectly radial calice, can be explained by the occurrence within the living rugose polyp of a single ventral siphonoglyph or gonidial groove, such as is characteristic of Zoanthid polyps.

New Type of Alcyonarian.‖—J. Versluys, jun., describes *Bathyalcyon robustum* g. et sp. n., obtained on the Siboga expedition in the Ceram Sea from a depth of 924 metres. The single specimen looked at first sight like a large solitary polyp, but closer examination showed that it

* Annals Natal Government Museum, i. (1906) pp. 73–96 (3 pls.).
† Proc. Acad. Nat. Sci. Philadelphia, lvii. (1905, published 1906) p. 754.
‡ Bull. Mus. Comp. Zool., l. (1906) pp. 61–72 (10 pls.).
§ Ann. Nat. Hist., xviii. (1906) pp. 227–42 (21 figs.).
‖ Zool. Anzeig., xxx. (1906) pp. 549–53 (4 figs.).

was a colony with a single central sterile autozooid, mostly surrounded by a sparse cœnenchyma in which there are numerous small fertile siphonozooids, less abundant towards the base and finally absent at the very foot. This interesting type seems to be nearly related to *Anthomastus*, especially to the form which Hickson referred to Verrill's *A. grandiflorus*. Morphologically it is a dimorphic colony; physiologically it is a solitary polyp with gonads imbedded in its walls.

Structure of Spongodes.*—W. Harms points out that there are, according to Kükenthal, 95 species of *Spongodes* or *Dendronephthya*, that in most cases only a few specimens of each species have been studied, and that there is reason to suspect great variability and modifiability. It is therefore necessary to get below superficialities and investigate the detailed internal structure, in regard to which relatively little is known. Harms has therefore studied a number of species, and describes in a general way the spiculation (noting the occurrence of hollow spicules), the tentacles, the stomodæum, the ventral "spicular cavities" on the polyp-wall for the reception of the "Stützbündel," the mesenteric filaments, the gonads, and the canal-system. The general result is to show the essential anatomical similarity of different species; the internal structure does not seem to help very much in deciding whether the so-called species are well defined or are only local varieties. The structure of the testes in specimens from Torres Straits is described.

Precious Corals.†—Sydney J. Hickson gives an interesting account of *Corallium*; its distribution, its ancient uses in medicine, and its naturai history. At present the coral fisheries of importance are in the Mediterranean, off the Cape Verd Islands, and off Japan. The bulk of Japanese coral is exported to Italy and China.

There is dimorphism in *Corallium nobile* (Moseley, 1882), and the gonads are in the autozooids (Lacaze-Duthiers, 1864); in *C. reginæ* Hickson found that the gonads are in the siphonozooids. The hermaphroditism of *C. nobile* described by Lacaze-Duthiers requires confirmation.

As the two characters which distinguish *Pleurocorallium*, viz. the position of the zooids on one side of the branches and the presence of peculiar "opera-glass" spicules, are not very important, this genus should be merged with *Corallium*.

The recent discovery of *C. johnsoni*, at a depth of 388 fathoms, off the west coast of Ireland, is a fact of considerable interest, as it extends the range much further north than that of any other species of the family.

Viviparity in Alcyonacea.‡—J. Arthur Thomson and W. D. Henderson have found embryos—gastrulæ and slightly older stages—in a number of deep-sea Alcyonacea from the Indian Ocean; species of *Sarcophytum*, *Chrysogorgia*, *Ceratoisis*, *Paramuricea*, *Umbellula*, *Funiculina*, and *Pennatula*. Viviparity has been previously observed in *Corallium rubrum*, by Lacaze-Duthiers; in some *Clavularia* species, *Sympodium*

* Zool. Anzeig., xxx. (1906) pp. 539–48 (12 figs.).
† Ann. Rep. and Trans. Manchester Micr. Soc. for 1905 (1906) pp. 29–38.
‡ Zool. Anzeig., xxx. (1906) p. 504.

coralloides, by Marion and Kowalevsky; in three species of *Nephthya*, by Koren and Danielssen; and in *Gorgonia capensis*, by Hickson. The authors confirm Hickson's discovery of embryos in *Gorgonia capensis*, and note that J. J. Simpson has found embryos in *Isis hippuris*. It is suggested that there may be some correlation between viviparity and abyssal habitat; but it also occurs in some littoral species of *Clavularia*.

New Type of Virgularid.*—Ch. Gravier describes a new type of Virgularid from Djibouti, which he proposes to call *Scytaliopsis*, because of its resemblance to *Scytalium*. The largest specimens were about 12 cm. in length; the rachis bears polypiferous non-spiculate lamellæ with five or more polyps; on the dorsal surface between adjacent lamellæ there is a double row of siphonozooids, one between each pair of lamellæ; on the ventral surface small tubes from the internal cavity open to the exterior; there is a rigid calcareous axis in a cavity divided by partitions into four canals; the polyps have distinct calices; sex-cells occur in the incompletely developed polyps in the lower region of the rachis; the siphonozooids communicate with the dorsal and lateral canals, the ventral canal communicates by numerous ciliated tubes with the exterior; the occurrence of these tubes may be correlated with the exceptionally small number of siphonozooids.

Mobility of Virgularids.†—Ch. Gravier notes that these colonies have more mobility that is usually supposed. He observed living specimens of a new type found at Djibouti (*Scytaliopsis*). Specimens laid horizontally on the sand show a torsion of the terminal portion of the peduncle. There is turgescence and muscular movement; the colony gradually works its way into the sand.

Studies on Graptolites.‡—Sv. Leonh. Törnquist describes a number of new Graptolites, from the lower zones of the Scanian and Vestrogothian *Phyllo-Tetragraptus* beds, belonging to the genera *Bryograptus*, *Trichograptus*, *Tetragraptus*, *Phyllograptus*, *Dichograptus*, *Clonograptus*, *Temnograptus*, *Anthograptus*, *Schizograptus*, *Holograptus*, and *Azygograptus*.

Porifera.

Antarctic Axinellid.§—J. Arthur Thomson and J. D. Fiddes describe a single specimen of what appears to be a species of *Axinella*, dredged by the 'Scotia' from deep water between Gough Island and Cape Town. It consisted of a substantial branched axis, 26 cm. in length, composed of densely packed styles imbedded in a spongin framework, but unfortunately without any trace of soft tissue.

Protozoa.

British Fresh-water Rhizopods.‖—James Cash, assisted by John Hopkinson, has done a useful piece of work in producing this manual,

* Comptes Rendus, cxlii. (1906) pp. 1290–1.
† Tom. cit., pp 1556-8.
‡ Acta Univ. Lund., xl. (1904, received 1906) pp. 1–29 (4 pls.).
§ Proc. R. Phys. Soc. Edinburgh, xvi. (1906) pp. 231–2.
‖ The British Freshwater Rhizopoda and Heliozoa. I. Rhizopoda. Ray Society, i. (London, 1905) x. and 148 pp., 16 pls. and 32 figs.

which gives a systematic account of the known fresh-water Rhizopods of Britain. In the order Amœbina he deals with three families and fourteen genera:—(1) Lobosa (*Amœba, Dactylosphærium, Mastigamœba, Pelomyxa, Lithamœba, Ouramœba*); (2) Reticulosa (*Gymnophrys, Biomyxa, Penardia, Chlamydomyxa*); (3) Vampyrellida (*Vampyrella, Hyalodiscus, Nuclearia, Archerina*). For the shelled fresh-water Rhizopods the term Conchulina is suggested to replace Testacea, and in this volume the genera *Arcella, Pseudochlamys*, and *Centropyxis* are dealt with. It is to be hoped that this publication will stimulate a much neglected study.

Antarctic Protozoa.*—Olaw Schröder makes a preliminary report on a remarkable type (*Cytocladus* g. n.) collected by the German South Polar Expedition. They look like large spherical Radiolarians with twelve radial beautifully branched spines. The cytoplasm consists of five much-branched arms arising from a median portion, which lies eccentrically in the skeletal sphere and is not perforated or touched by the spines. A somewhat flat round disk is probably the nucleus, but no central capsule could be definitely distinguished.

New Species of Cytocladus.†—Olaw Schröder has previously described two species of this interesting Radiolarian-like genus, and he now describes a third (*Cytocladus spinosus* sp. n.) from Japan, which is interesting in showing a central capsule divided into twelve branches, surrounded by a very delicate membrane, but showing neither pores nor larger openings. The discovery of the central capsule removes doubt as to the Radiolarian character of this remarkable type.

Acanthocystis pertyana.‡—J. E. Lord describes this Heliozoon, which he found in a pond near Manchester. He points out that it, as defined by Archer, is almost certainly the same as an unnamed species described by Leidy, and is very probably identical also with Perty's *A. brevicirrhis*. He has been able to prove the presence of a skeletal test in addition to the spines, and notes that this ought to be included in the generic characters. The test seems to consist of short interlacing rods, soldered together by some cementing material.

Function of Contractile Vacuole.§—Albert Degen has studied the contractile vacuole of *Glaucoma colpidium*. It is originally an osmotic system, preventing undue imbibition of water, but it aids in respiration, excretion, and perhaps circulation. There is a special vacuole-membrane, which mediates between the osmotic conditions in the cytoplasm and in the vacuole. The physiological conditions of the diastole and systole are discussed in detail. The factors altering the rate of pulsation are analysed; thus a rise of temperature above 34° C. accelerates, increased oxygenation of the water accelerates, neutral substances such as cane-sugar and glycerin retard. But this is only an indication of the general scope of Degen's investigation.

* Zool. Anzeig., xxx. (1906) pp. 448–54 (9 figs.).
† Tom. cit., pp. 587–90 (1 fig.).
‡ Report and Trans. Manchester Micr. Soc. for 1905 (1906) pp. 41–4 (1 pl.).
§ Bot. Zeitung, lxiii. (1905) pp. 160–202 (9 figs.).

Alveolar Structure of Infusorians.*—A. Degen finds that the honeycomb or alveolar structure of *Glaucoma* and other Infusorians is not normal, but a reaction to injurious influences. It may be induced by mechanical pressure, deconcentration, and many chemical reagents.

New Chrysomonad Genus.†—R. Lauterborn describes *Palatinella cyrtophora* g. et sp. n., a new Chrysomonad related to *Pedinella* and to *Chrysamœba*.

Reproduction of Tintinnodeæ.‡—Hans Laackmann has studied *Tintinnopsis campanula* and *Cyttarocylis helix*, and describes the behaviour of the nuclei during division, the sexual reproduction by means of macro- and microspores, the process of conjugation, and the formation of protective cysts.

Modifications of Cytoplasm of Opalina.§—J. Kunstler and Ch. Gineste have studied the changes in the minute structure of *Opalina* when the frogs in which the Infusorians live are out of health. The characteristic cytoplasmic structure disappears, and gives place to a "continuous mucous substance" with a crowd of granulations. Similarly, when the Infusorians are kept in salt solution all internal differentiation disappears.

Observations on Volvox.‖—W. Stempell has studied *Volvox aureus* Ehrbg. (= *minor* Stein). He confirm's Overton's observation as to a "polar plateau" in female colonies, i.e. an area where agamic cells are quite absent. It always lies at the pole which is posterior in locomotion. The movement of the colony is described—it is like that of a ciliated Infusorian, not a simple rolling round the water. At certain times all the colonies show only parthenogonidia or parthenogenetic daughter-colonies; at other times two combinations predominate, (*a*) colonies with macrogametes only, and (*b*) colonies with parthenogonidia and microgamete bundles. There seems to be cross fertilisation. The movements of the microgametes are described, but the actual fertilisation —which seems to require intense illumination—was not observed. After the macrogametes of a colony are fertilised, there is a marked change in the reactions to light.

Hæmoflagellata.¶—H. M. Woodcock gives a very complete and useful review of present knowledge relating to the Trypanosomes and allied forms. All the more important papers published up to February 1, 1906, have been considered in the compilation. Naturally, Schaudinn's work receives a considerable share of attention, and his results on the life-histories of *Trypanomorpha noctuæ* and *Trypanosoma ziemanni* are fully detailed. Concerning the attempts to cultivate Trypanosomes in artificial media, the author says, "It cannot be too strongly insisted that this is not a zoological method of research, and that the results obtained do not add to our knowledge of the parasite's

* Bot. Zeitung, lxiii. (1905) pp. 202–26 (1 pl. and 6 figs.).
† Zool. Anzeig., xxx. (1906) pp. 423–8 (3 figs.). ‡ Tom. cit., pp. 440–3.
§ Comptes Rendus, cxliii. (1906) pp. 365–7 (2 figs.).
‖ Zool. Anzeig., xxx. (1906) pp. 535–9.
¶ Quart. Journ. Micr. Sci., l. Nos. 197 and 198 (1906) pp. 151–331 (65 figs. in text).

real life-history and biology, but must be accepted as normal phases only with the greatest caution." The facts, as far as known, regarding the Leishmann-Donovan body, and artificially-produced developmental forms, are clearly stated. This parasite, it is concluded, most probably has at some period or another a typical trypaniform phase. On the question of the nature of the Spirochætæ, the author agrees with Schaudinn (1) that the organisms exemplified by *Spirochæta plicatilis* Ehrenberg are to be widely separated from *Trypanosoma ziemanni* Schaudinn—and equally, of course, from other Trypanosomes—with which they have at most only a very remote phylogenetic connection; and (2) that, at any rate, certain other spirilliform parasites, e.g. *Spirochæta refringens* and *S.* (*Trypanosoma*) *balbianii* agree fundamentally in structure with *S. plicatilis*, the type species. Where exactly amongst micro-organisms *Spirochæta* is to be placed, e.g. how close to or distant from *Spirillum*, is not discussed; the available evidence, the author thinks, is against this form having anything to do with the parasitic Flagellates. It would appear that the parasites hitherto grouped together under the general heading of Spirochætæ include two quite distinct types of organism. *Spironema pallidum* Schaudinn (= *Trypanosoma luis* Krzysztalowicz and Siedlecki) of syphilitic lesions, is allied, not to the Spirochætæ, but rather to the Flagellates, possessing as it does, in certain phases at least, markedly trypaniform characters. Further careful investigation of all the forms (including, e.g. "*Spirochæta*" *obermeieri* and "*S.*" *anserina*) is necessary with a view to their correct classification. An exhaustive bibliography accompanies the paper.

Myxobolus from Head of Haddock.*—M. Auerbach describes *Myxobolus æglefini* sp. n. from the head of *Gadus æglefinus*. It closely resembles *M. mülleri* Bütschli, but seems to be distinct.

Blood-inhabiting Protozoa.†—Muriel Robertson discusses *Trypanosoma brucei* (in the guinea-pig); *T. pythonis* sp. n. from an African python; a Trypanosome found in the blood of *Pleuronectes platessa*, and *P. flesus*, a Hæmogregarine from the same hosts; *T. raiæ* Laveran and Mesnil from *Raia microcellata*; and a Hæmogregarine from the same fish.

New Myxosporidian from the Tench.‡—Louis Leger has found in *Tinca vulgaris* what seems to be a new species of *Chloromyxum* (*C. cristatum*). It occurred in fishes which were much infested with *Chilodon cyprini*.

New Trypanosome.§—A. Laveran describes *Trypanosoma cazalboni* sp. n., from Nigeria. It occurs in Equidæ and Bovidæ; it is readily inoculated into sheep, goats, and antelopes; it is not usually introducible into mice, rats, guinea-pigs, or dogs. It seems to be disseminated by species of *Tabanus*.

Spleen Emulsion as an Antagonist of Nagana Trypanosomes Introduced into Dogs.‖—G. Roux and L. Lacomme find that when

* Zool. Anzeig., xxx. (1906) pp. 568–70 (4 figs.).
† Proc. R. Phys. Soc. Edinburgh, xvi. (1906) pp. 232–47 (2 pls.).
‡ Comptes Rendus, cxlii. (1906) pp. 1097–8.
§ Op. cit. cxliii. (1906) pp. 94–7.
‖ Tom. cit., pp. 135–7.

Trypanosoma brucei is inoculated into dogs an injection of emulsion of ox-spleen causes their disappearance within three days.

Life-history of Spirochæta pallida.*—Fr. Krzysztalowicz and M. Siedlecki discuss the life-history of this "Flagellate Protozoon" found by Schaudinn in syphilitic lesions, and show that one of the phases in its cycle is a Trypanosome form to which they apply the name *Trypanosoma luis*.

The Genus Piroplasma.†—H. B. Fantham gives an account of *Piroplasma muris* sp. n., occurring in the blood, liver, spleen, etc., of white rats. The parasite is usually ovoid or pyriform in the trophozoite stage, generally with a single well-marked chromatin dot; it multiplies by binary fission into two merozoites; melanin pigment is absent. Investigation has shown that the genus *Piroplasma* stands distinctly apart from the other Hæmosporidia. It may be that the Hæmosporidia, as at present understood, form a heterogeneous group.

Myxosporidian in South African Rotifer.‡—E. Warren gives some account of the structure and life-history of *Bertramia kirkmani* sp. n., which has been found in about 60 p.c. of collected examples of a species of *Copeus* occurring at Pietermaritzburg. This parasite exhibits undoubted affinities with the Sarcosporidia, but it differs from them in that the trabeculæ divide the trophoplasm into single spores, and not into pansporoblasts. No trace of a polar capsule, or even the striated area described in the spores of *Sarcocystis*, could be detected. It differs from a typical *Myxosporidium* in that spore formation typically terminates the trophozoite stage, the whole of the trophoplasm being converted into the spores. *Bertramia kirkmani* is to be regarded as derived from a Myxosporidian ancestor, its structure and life-history having become modified and simplified in accordance with the special conditions occurring in its comparatively short-lived host.

* Bull. Internat. Acad. Sci. Cracovie, No. 9 (1905) pp. 713–28 (1 pl.).
† Quart. Journ. Micr. Sci., l. No. 199 (1906) pp. 493–516 (1 pl.).
‡ Annals Natal Government Museum, i. (1906) pp. 7–17 (1 pl.).

BOTANY.

GENERAL,

Including the Anatomy and Physiology of Seed Plants.

Cytology,

including Cell-Contents.

Cell-division in Œdogonium.*—G. Kraskovits has made a careful investigation of the phenomena connected with this subject, and his conclusions are somewhat different from those of other authors. He finds that the ring is composed of two layers, the central one being formed from the cell-membrane by a process of liquefaction. One zone of the enveloping membrane liquefies and forms the primary substance of the ring. The consequent attenuation of this membrane facilitates the subsequent tearing at that spot. When the primary ring-substance is fully formed, a new membrane is formed along the entire surface of the cell-envelope, and this is thicker in the parts surrounded by the ring. This process occurs in every case of cell-division. The caps and sheaths which are formed by the tearing of the membrane over the ring, represent the remains of the next oldest membrane-layers which were formed in a similar manner. The caps and sheaths are not necessary parts of the cell-unit, and may indeed disappear in some living cells without harm to those cells. The tearing of the cell-membrane over the ring is facilitated by the swelling action of the ring-mucilage, which increases largely in size by the absorption of water. This mucilage takes part also in the formation of the cuticle over the intercalary membrane between the cap and the sheath. In the young germinating plant cell-division may take place with or without ring-formation, depending on the species. In either case the first division of the unicellular plantlet appears to differ from all subsequent divisions in the plan and formation of the inner layer. The author details his method, and gives a list of the reagents employed. His material consisted of plants of *O. crispum*, *O. Vaucherii*, *O. capillare* var. *natans*, and *O. æruginosum*.

Chemistry of Fungi.†—C. Gessard has tested the sap of *Russula delica*, and finds that it contains laccase, tyrosynase, and peroxydase. He has experimented with it on hares, and gets a serum that is anti-peroxydase.

J. Zellner ‡ gives an account of the various substances he has found in *Amanita muscaria*. He remarks on the unusual quantity of mannite present in dried fungi as compared with freshly gathered specimens.

* SB. k. Akad. Wiss. Wien. cxiv. (1905) pp. 237–274 (3 pls.).

† Comptes Rendus Soc. Biol. Paris, lx. (1906) pp. 505–6. See also Bot. Centralbl., cii. (1906) p. 149.

‡ SB. k. Akad. Wiss. Wien. Math.-Nat. Kl., cxv. (1906) pp. 105–17. See also Bot. Centralbl., cii. (1906) p. 150.

A fermentative process is present which works during the drying of the fungus and produces this substance.

Studies of Protoplasmic Continuity.*—Thorild Wulff has made careful examinations of the cells of grasses in view of Eriksson's theory that the mycoplasma passes from the cell to the intercellular space through the same channels as the protoplasmic strands. He finds that these strands pass from cell to cell, but not between any cell and an intercellular space, nor does he consider that these channels are of any service to fungal hyphæ passing from cell to cell. The strands are most easily demonstrated in endosperm; they are less easily detected in the cells of the mesophyll or epidermis; while, in the embryo, it is almost impossible to prove their existence.

Structure and Development.

Vegetative.

Structure of Cretaceous Pine-wood.†—E. C. Jeffrey and M. A. Chrysler have examined the structure of partially charred lignites belonging to the genus *Pityoxylon* from the Middle Cretaceous beds at Kreischerville, Staten Island. The structure differs from that of existing pines in the absence of marginal tracheids in the rays, in the highly resinous nature of the rays, and in the association of characteristic features of the hard pines, as exemplified by leaf-fascicles, cone-scales, and structure of the primary wood, with the numerous tangential pits of the autumnal wood, which are a feature of the living soft pines. The authors regard these points of difference from modern pines as ancestral, since they persist clearly and strongly in the structure of the wood of the cones of the living species. The appearance of marginal tracheids in the rays of *Pinus* is comparatively modern and does not in all probability antedate the Tertiary period. It probably explains the greater prosperity of the genus in recent times.

Spermatozoids of Cycas.‡—The Japanese botanist Miyake has studied the structure and movements of living spermatozoids. They vary in diameter from 180–210 μ and are surrounded by a delicate membrane, but it is uncertain whether this membrane belongs to the spermatozoid or is only the *Hautschicht* of the protoplasm of the pollen-tube. The movements which were observed in a 10 p.c. cane-sugar solution, often continued for one to three hours, rarely for five to six hours; the forward movement is accompanied by a rotation about the axis from left to right, and sometimes amounted to 0·7 mm. per second. The author finds that the liquid in the pollen-chamber at the time of fertilisation comes from the pollen-tube and not from the archegonium.

Physiology.

Nutrition and Growth.

Micro-organisms as Aids to Digestion in Drosera rotundifolia.§ The theory had already been put forward by R. Dubois that the pheno-

* Oesterr. Bot. Zeitschr., lvi. (1906) No. 1, pp. 1–8; No. 2, pp. 60–69 (1 pl.).
† Bot. Gazette, xlii. (1906) pp. 1–15 (2 pls.).
‡ Ber. Deutsch. Bot. Gesell., xxiv. (1906) pp. 78–83 (1 pl.).
§ Thèse de l'École supérieure de Pharmacie de Paris. Laval: A. Goupil, 1904, 101 pp. See also Bot. Centralbl., cii. (1906) pp. 333–4.

mena of digestion observed in *Nepenthes* were probably due to enzymes secreted by bacteria. E. Labbe has found something of the same kind in *Drosera*, though here the bacteria play only a secondary part. Moulds such as *Aspergillus glaucus*, *Penicillium glaucum*, *Mucor Mucedo*, and *Cladosporium herbarum*, with a few bacteria, were found to be present. They provoke fermentation of the sugar secreted by the glands of the plants, and give origin to certain acids. A proteolytic ferment which peptonised fibrin was found in the secretion.

Mycorhiza and Nitrogen Assimilation.*—A. Möller has recently conducted experiments with seedling pines to determine whether the mycorhiza of the roots could make use of the free nitrogen of the atmosphere in the absence of other sources of supply. He grew plants in a soil free from nitrogen, and others in soil supplied with saltpetre. The latter grew much more vigorously, and an examination of the products of each set of plants gave these a great preponderance in weight, amount of nitrogen, etc. Möller considers that his results prove that mycorhiza does not assimilate free nitrogen.

Irritability.

Hygroscopicity as a Cause of Physiological Action at a Distance.† The late Professor L. Errera chose *Phycomyces nitens* to study what Elving had called a "new 'tropism' depending on a strange and unknown force." *Phycomyces* was chosen for experiment on account of its sensitiveness: it is negatively geotropic, positively heliotropic, negatively hydrotropic and thermotropic, and positively haptotropic. Errera found that the unknown agent which attracts or repels is simply water vapour; and three factors have to be taken into account: the energy, duration, and quickness of absorption. A great number of substances were used in testing the hydrotropism of the plant, including metals, salts, acids, and organic substances, and the results of the experiments are given.

Chemical Changes.

Action of Insoluble Substances in Modifying the Effect of Deleterious Agents.‡—The research on this subject undertaken by Ruby Fitch is a continuation of work done by Nägeli, who discovered the hurtful influence of minute quantities of poison in water cultures of plants, and who proved further that the poisonous effect could be neutralised by the introduction of insoluble substances such as granite, cotton-fibre, etc. The writer of this paper experimented with *Aspergillus niger* and *Penicillium glaucum*; sand, glass, filter-paper, and porous clay pipes were the insoluble substances; copper sulphate and sulphuric acid were the toxic agents introduced into the culture media. Exact tables of results are given, but generally the results agreed with those of Nägeli, and these insoluble substances (sea-sand was the most effective) "acted as agents of dilution or absorption, removing in some way poisonous molecules or ions."

* Ber. Deutsch. Bot. Gesell., xxiv. (1906) pp. 230–3.

† Recueil Inst. Bot. (de Bruxelles) vi. (1905) pp. 301–66 (5 pls.). See also Bot. Centralbl., cii. (1906) pp. 215–17.

‡ Ann. Mycol., iv. (1906) pp. 313–22.

Cyanogenesis in Plants.*—Wyndham Dunstan, T. A. Henry, and S. J. M. Auld have investigated the occurrence of the glucoside phaseolunatin in common flax. Results obtained by estimating the amounts of hydrocyanic acid in the seed and at various stages in the growth of the plant show that the seed contains a small amount of the glucoside, which increases on germination, reaches a maximum at a very early stage in the growth of the plant (when it is from 2–3 inches high), and then diminishes steadily and disappears. These results contrast with those previously obtained with *Lotus arabicus* and *Sorghum vulgare*, where none of the glucoside is present in the seed. The glucoside when isolated proved to be identical with that obtained from the seeds of *Phaseolus lunatus*, and the same enzyme, capable of hydrolysing the glucoside, probably exists in the seeds of both plants. The same authors find that the same glucoside is present in the cassava-plant (*Manihot utilissima*), together with an enzyme capable of decomposing it.

Fat-splitting Ferment of the Higher Fungi.†—J. Zellner found that the fat of the higher fungi contained a large amount of fatty acids, which tended to increase with age. The ferment splits up to 80 p.c. of the fat, though the complete destruction of the fat has never been observed. Slight heating aided the process. A temperature of 110° C., or the addition of sublimate, stopped the action. It has not been possible to isolate the ferment.

General.

Julianiaceæ, a New Family of Seed-plants.‡ — W. B. Hemsley founds a new natural order of Seed-plants on two peculiar genera, *Julania* and *Orthopterygium*, natives respectively of Mexico and Peru. Both genera have been previously known only from very incomplete material. The plants are resin-containing, deciduous, diœcious shrubs or small trees with alternate, exstipulate, imparipinnate leaves. The flowers are small, green or yellow-green, and the males are very different from the females. The former are in structure and appearance almost exactly like those of the common oak; the female inflorescence is similar in structure to that of the sweet-chestnut, consisting of an involucre containing three or four collateral flowers, the two outside ones of which are abortive. The female flowers are naked, and consist of a flattened one-celled ovary, with a trifid style, and containing a solitary ovule, which has a peculiar structure, having a remarkably developed funicle; it has one integument. The fruits are samaroid, the wing being formed from the upper part of the pedicel. The nuts are orbicular, with a very hard endocarp, and contain a solitary exalbuminous seed. The embryo has thin, obscurely lobed epigeal cotyledons. The author compares the proposed new order with the Anacardiaceæ and Cupuliferæ, and suggests that the latter is the more nearly allied. The position of the order is apparently between the Juglandaceæ and the Cupuliferæ.

* Proc. Roy. Soc., Series B, lxxviii. (1906) pp. 145–58.
† SB. k. Akad. Wiss. Wien. Math.-Nat. Kl., cxv. (1906) pp. 119–28. See also Bot. Centralbl., cii. (1906) p. 120.
‡ Proc. Roy. Soc., Series B, lxxviii. (1906) pp. 231–6.

CRYPTOGAMS.

Pteridophyta.

(By A. Gepp, M.A., F.L.S.)

Index Filicum.*—C. Christensen has published parts xi. and xii. of his Index Filicum, thereby bringing that important work to completion. The contents of these parts are: the end of the alphabetical enumeration of the species and their synonymy, the entries of which in the whole work reach a total of more than 22,000; about ten pages of addenda and corrigenda; an alphabetical catalogue of all fern-literature, containing descriptions of new genera and species, occupying sixty-eight pages; a systematic enumeration of literature arranged according to geographical areas, and also according to the genera or groups monographed; and, finally, a systematic enumeration of the genera, with all synonyms chronologically and systematically arranged.

Chinese Ferns.†—J. G. Baker and C. H. Wright publish descriptions of twenty-six new species of Pteridophyta which, with two exceptions, were collected in China by Henry and others.

Ferns of Madagascar.‡—J. Palacký issues a catalogue of the ferns of Madagascar for the use of collectors and others.

Ferns of the Philippine Islands.§—E. B. Copeland publishes an account of 76 new Philippine ferns, 43 of which are new to science, and the rest additions to the Philippine flora. Hillebrand's neglected genus *Schizostege* is revived and fortified by the addition of two new species; it is allied to *Pteris* and *Cheilanthes*. *Prosaptia* of Presl is maintained as an ally of *Polypodium*; and another near ally is *Acrosorus*, a new genus proposed for a few species which had been placed in *Davallia*. *Thayeria* is a new genus of close affinity to *Drynaria*.

Sicilian Ferns.‖—F. Cortesi gives a list of twenty-five Pteridophytes preserved in the old herbarium collected by Count Cesare Borgia (1776–1837), formerly kept at Velletri and recently transferred. The specimens were collected in Italy and Sicily.

Ferns of Christmas Island.¶—H. N. Ridley, in the account of his expedition to Christmas Island, gives a list of twenty-five Pteridophyta, three of which are endemic, one being a new species of *Selaginella*.

Ferns of Florida.**—A. A. Eaton gives an account of the Pteridophytes observed by him in southern Florida during three excursions. These amount to 56 species, 13 of which are additions to the flora of the United States, and one is new to science. New descriptions are

* Copenhagen: Hagerup, 1906, pp. i–lx. and 641–744.
† Kew Bull. Misc. Information, 1906, pp. 8–15.
‡ Filices Madagascarienses. Prag: Frank, 1906.
§ Philippine Journ. of Sci., i. Suppl. 2 (1906) pp. 143–67 (28 pls.).
‖ Annali di Botanica, iv. (1906) pp. 260–2.
¶ Journ. Straits Branch R. Asiatic Soc., No. 45 (1905) pp. 245–8.
** Bull. Torrey Bot. Club, xxxiii. (1906) pp. 455–86.

supplied to several of the species; critical remarks and plentiful field-notes are added; and the physical and botanical features of the region are described.

Muscineæ.

(BY A. GEPP.)

Variation of Form in the Bryophyta.*—V. Schiffner gives his views on this subject. Bryophytes may be ranged in three groups:—(1) species which do not vary in form, but require fairly definite conditions of life; (2) species which possess some degree of adaptability to change of environment, and exhibit corresponding variations of form; (3) species with a much greater power of adaptation, and exhibiting great variety of form—the polymorphous species. These polymorphous species are the plague of the systematists, leading to the creation of an excess of new species which would certainly be reduced to mere sub-species, varieties, or forms, if bryologists had a truer knowledge of how the species varies within its own limits. A given species may be a xerophyte, mesophyte, hygrophyte, or hydrophyte; its forms may be typical, depauperate, luxuriant, etiolated, alpine or polar, maritime, coloured. It becomes necessary to ascertain what is the normal form of the species, what are its extremes, and what are the links which connect the extremes with the normal.

Barbula Fiorii.†—F. Quelle records the occurrence of this moss in the southern Harz mountains. It had previously been found only on gypsum hills near Modena in the north of Italy. The plant is peculiar, and is closely allied to *B. revolvens* Schimp., with which it forms a distinct sub-genus, called *Cylindrometopon* by the author, characterised by its broad ovate leaves and a strongly revolute foliar margin. Both of the species are typical xerophytes. The original descriptions of the two plants are compared in parallel columns. The *B. Fiorii* of the Harz is an inconspicuous earth-moss, dioicous, and seldom fertile. The author gives a minutely detailed description of the plant, describes its distribution on the gypsum strata and its absence elsewhere, and gives a list of the mosses and lichens with which it associates.

Mosses of New Caledonia.‡—V. F. Brotherus publishes a list of mosses of New Caledonia, which adds 55 to the total of 157 species or varieties previously recorded for the islands. Some 60 p.c. are endemic. Among the new records are twenty-eight species new to science, one of them representing a new genus, *Parisia neocaledonica*, remarkable for its longly piliferous nerveless leaves. It is placed in the list between *Campylopus* and *Synodontia*.

Mosses of Tonkin and Cayenne.§—E. G. Paris gives a list of seven mosses and two hepatics collected in Tonkin by L. Boutan. Three of the species are new. In another list he gives twelve mosses and seven hepatics collected in Cayenne by A. Michel. Four of the species are new to science.

* Hedwigia., xlv. (1906) pp. 298–304. † Tom. cit., pp. 289–97 (1 pl.).
‡ Oefv. Finsk. Vet. Soc. Foerh., xlviii. (1905–6) No. 15, 27 pp., 1 pl.
§ Rev. Bryolog., xxxiii. (1906) pp. 55–8.

Muscineæ of Christmas Island.*—H. N. Ridley, in the account of his expedition to Christmas Island, gives a list of fifteen mosses and an hepatic, determined by A. Gepp. Two of the mosses are new to science.

South American Mosses.†—V. F. Brotherus publishes another list of mosses collected by E. Ule. The total of these is 113 species, and they were gathered on the Amazon and Lower Andes. Among them are forty-four new species. *Uleobryum peruvianum* represents a new genus of Pottiaceæ. It is apparently most nearly related to K. Müller's *Phasconica*, and somewhat resembles *Microbryum* in habit.

North American Muscineæ.—C. C. Haynes ‡ points out the resemblances and differences between *Cephalozia fluitans* and *Lophozia inflata*, and cites Schiffner's discovery that the deciduous perianths of the latter function as organs of vegetative reproduction. Figures are given. A. W. Evans § describes *Lepidozia sylvatica*, a new species of hepatic split off from *L. setacea*. It occurs in several of the eastern States. G. N. Best ‖ describes and figures *Ptychomitrium Leibergii*, a new species of moss gathered in Arizona.

Yorkshire Mosses.¶—W. Ingham records stations for some new and rare Yorkshire Muscineæ — *Physcomitrella patens*, *Weisia mucronata*, *Bryum murale*, and *Jungermannia Goulardi*. This latter was previously unknown in the British Isles, and, in Macvicar's opinion, would be better regarded as a variety of *J. sphærocarpa*.

Luminosity of Schistostega.**—T. Gibbs describes the vivid luminosity displayed by the protonema of this moss when suitably illuminated, comparable to the metallic green seen on the breast of some humming-birds. The plant occurs in crevices and rabbit-burrows at several places in Derbyshire, but always on the Millstone Grit.

New Scotch Mosses.††— J. Stirton describes the following new species and varieties of Scotch mosses: — *Cynodontium asperellum*, *Campylopus prasinorufus*, *C. rubiginosus*, *C. purpurascens* var. *Kinlayanus*, *Barbula viridescens*, *Leptotrichum confertum*, *Hypnum anomalum*, *Plagiothecium trichodeum*, and *Ceratodon conicus* var. *acicularis*. Also *Campylopus Dickieanus* from Lake Nyami in Central Africa. He finds *Didymodon Jenneri* Schimp. (1868) to be synonymous with *Cynodontium laxirete* Dixon, with *C. polycarpoides* Stirt, and *C. polycarpum* var. *lævigatum* Hagen, and re-christens it *C. Jenneri*. Under *Dicranidia fuscorufa*, he gives details of what is apparently a new moss previously mistaken for *Dicranella curvata*. He sinks *Barbula assimulans* Stirt. into a variety of *B. insulana*, and re-describes *Leptotrichum compactum* Stirt.

French Hepaticæ.‡‡—I. Douin publishes an annotated list of seventy-three species of Hepaticæ, thereby extending the known distribution of

* Journ. Straits Branch R. Asiatic Soc., No. 45 (1905) pp. 248–50.
† Hedwigia, xlv. (1906) pp. 260–88.
‡ Bryologist, ix. (1906) pp. 74–6.
§ Tom. cit., pp. 77–8.
‖ Tom. cit., pp. 79–81.
¶ Naturalist, No. 593, 1906, p. 187.
** Tom. cit., p. 301.
†† Ann. Scot. Nat. Hist., 1906, pp. 106–13.
‡‡ Rev. Bryolog., xxxiii. (1906) pp. 65–75.

these species in France. He adds two notes treating of the resistance of these plants to extermination by drought, and of the dependence of some of the species upon the presence of man, some practically occurring only in cultivated fields, others lying dormant until hedges are trimmed back, and then gradually becoming stifled again, others abounding along new railway cuttings.

Swiss Muscineæ.*—P. Culmann publishes a list of 25 hepatics and 71 mosses gathered by him in Switzerland, adding special notes on the probable identity of *Webera commutata* with *W. gracilis*, and *Brachythecium densum* with *Amblystegium compactum*, and on the difference between *Hypnum dilatatum* and *H. alpinum*, as shown in their perichætial leaves. He also states that the Norwegian moss, No. 826 of Husnot's Musci Galliæ, published under the name *Webera lutescens*, is not that species, but *Mniobryum vexans*.

Muscineæ of the Dolomites.†—F. Kern gives a list of 139 mosses and 17 hepatics gathered by him in the Dolomites in 1896, 1899, and 1903. He remarks upon the preference shown by the older bryologists for the Hohen Tauern range, and the neglect manifested as a rule for the Dolomites. He mentions certain bryologists who did visit the Dolomites, and some of the more remarkable species which they discovered. Although some of the Dolomites are composed of magnesian limestone and others of limestone, the author can detect no difference in the nature of their respective moss-floras. The constant weathering of the surface makes these mountains unfavourable for the growth of mosses; and where they do occur luxuriantly on rocks in the forests, they are but common calcareous species of the plain. All silicicolous species, as well as *Sphagnum*, *Andreæa*, and cleistocarpous mosses, are unknown there. But as regards the cleistocarps, their occurrence in the early spring, before the German bryologists reach the Dolomites, may account for their apparent absence. *Hypnum palustre* is the only representative of the *Limnobium* group. The hepatics are very scarce. Many species of mosses which otherwise occur only in the plains are found at high elevations on the limestone of the Dolomites.

German Mosses.—O. Jaap and R. Timm ‡ have submitted the neighbourhood of Hamburg to a fresh search for Muscineæ, and record 450 species. They have re-discovered all the hepatics formerly found by Gottsche, except *Blyttia Lyellii*, and have added others. The old moss records of Hübener and Sonder are not to be trusted, as many of them have never been confirmed. L. Loeske § publishes a further series of notes on the bryology of the Harz mountains. He corrects a few former determinations. He submits the species of *Philonotis* to a critical revision. *Lophozia confertifolia* Schiffn. is new for Germany; and five mosses and one hepatic are new for the Harz mountains.

Austro-Hungarian Mosses. — I. Györffy ‖ records several new localities for the rare moss *Acaulon triquetrum* in Hungary, having

* Rev. Bryolog., xxxiii. (1906) pp. 75–84.
† Jahresb. Schles. Gesell., lxxxiii. (1906) Abt. 2 *b*, pp. 7–19.
‡ Verh. Nat. Verein. Hamburg, xiii. (1906) pp. 105–51.
§ Verh. Bot. Verein. Prov. Brandenburg, xlvii. (1905) pp. 317–44.
‖ Növenyt. Közlemények., v. (1906) pp. 22–7 (10 figs.).

found it even in the Hohe Tatra, one of the stations being so high as 2350 ft. above sea level. E. Zederbauer * describes the different moss-associations found on various cultivation patches on the Austrian experimental farm in the Grosse Föhrenwald.

Various Moss Notes.—I. Hagen † publishes notes on a critical *Seligeria* (*S. patula* Lindb.) of Scandinavia and North America, on *Barbula squamifera* Viv., on *Fissidens luteofuscus* sp. n., from Japan, and on a forgotten bryological work by Roehling. A. Geheeb ‡ publishes notes on the following :—(1) *Gyroweisia reflexa* Brid., a species new to Spain; (2) a gall-formation caused by Nematodes in *Pterigynandrum filiforme*; (3) corrections of and additions to his previous paper on further contributions to the moss-flora of New Guinea. J. O. Bomansson § describes *Bryum pachydermum*, a new species allied to *B. excurrens*, and collected in Aland. I. Thériot describes a new variety of *Cinclidotus aquaticus* from Montenegro.

Anthoceros and its Nostoc Colonies.‖—G. J. Peirce gives the results of his experiments in cultivating *Anthoceros fusiformis* and *A. Pearsoni* in the presence and absence of *Nostoc*. The soil natural for the species was used, and in case of some of the cultures was steam-sterilised. In about twelve weeks after the sowing of the spores, the plants produced archegonia and antheridia. These organs were infrequent or absent on plants kept too much in the dark. The plants grown on sterilised soil were more robust than the others, and contained no *Nostoc* colonies. But even on unsterilised soil some of the plants escaped *Nostoc* infection, and appeared more robust than their fellows. Plants grown in a lateral illumination grew upwards to catch the light, and their elevated parts were consequently less accessible to *Nostoc*. *Anthoceros* appears to do better when free from association with *Nostoc*; and it does not appear that *Nostoc* benefits by the association. The fact that short internal hairs or chains of cells of the *Anthoceros* thallus grow into the mass of the *Nostoc* colony is simply a question of mechanical pressure and local resistances.

Lophocolea.¶—F. Stephani continues his monograph of the species of the genus *Lophocolea*, treating more particularly of the Australasian species. These latter are 70 in number, and the author here describes 26 of them, half of which are new.

Thallophyta.

Algæ.

(By Mrs. E. S. Gepp.)

How to Collect Algæ.**—M. Gomont gives some hints to travellers on the best and easiest methods of preparing algæ for an herbarium or for anatomical examination. He divides the algæ into two groups, large and small, the first including all species visible to the

* Die Moose in den Versuchsbeständen. Wien: W. Frick, 1906, 13 pp., figs.
† Rev. Bryolog., xxxiii. (1906) pp. 49-54. ‡ Tom. cit., pp. 58-60.
§ Tom. cit., pp. 60-61. ‖ Bot. Gazette, xlii. (1906) pp. 55-9.
¶ Bull. Herb. Boissièr, vi. (1906) pp. 781-96.
** Journ. de Bot., xx. (1906) pp. 18-22.

naked eye, the second all microscopic species. Every specimen should be carefully labelled with the name of the locality, and the nature of its habitat. The whole plant should be gathered, including its base. The robust specimens may be hung up to dry on a line in the shade, or laid out on some flat surface. More delicate plants are preferably to be spread out on a piece of sized paper, covered with calico and slightly pressed between blotting paper, which, as well as the calico, should be changed often, to insure speedy drying. When the specimens are dry, the calico is removed, and the sheets are packed on one another. A better plan is to float specimens in sea-water, and to slide a piece of paper underneath the plant, which can then be teased out and left on an inclined plane to drip. If sea-water be not available, a solution of 35–40 grm. of sea salt to every litre of water may be used instead. Another method is the employment of salt as a preservative. When fresh specimens have finished dripping, they are placed in a stone vase in alternate thin layers of algæ and salt, and the water that comes away having been carefully removed, the vessel is hermetically sealed. This method gives good results for a short journey; for a longer period it would ruin the specimens.

For microscopic algæ a quick drying in the open air on a sheet of sized paper is best, without calico or other pressure. Diatoms and Desmids may be placed in a drop of water on the paper and allowed to dry naturally. As regards the employment of liquids for preservation of algæ, the author deprecates the use of them, except for portions of plants destined for anatomical research. For these he recommends 90 p.c. alcohol to which he adds a certain quantity of glycerin, or a solution of picric acid.

Notes on Algæ.*—F. S. Collins continues his notes on various species of marine algæ, and in the present contribution treats of *Gobia baltica*, *Myrionema Corunnæ*, *Lithoderma fatiscens*, *Conchocelis rosea*, *Rhodomela lycopodioides*, *Rhodochorton penicilliforme*, *Rhododermis elegans*, *R. parasitica*, and *R. Georgii*.

Fresh-water Algæ of Bulgaria.†—S. Petkoff publishes a list of fresh-water algæ new to Bulgaria, collected in six different localities. Sixty-one species are enumerated, belonging to Schizomycetes, Florideæ, Cyanophyceæ, and Chlorophyceæ. This is the author's fifth contribution to a study of the fresh-water algæ of this country.

Sicilian Algæ.‡—F. Cortesi, in his "Illustrazione dell' Erbario Borgia," gives a list of 44 marine algæ from Catania, re-determined by G. B. de Toni, and preserved in the neglected herbarium which was put together by Count Cesare Borgia, who died in 1837. The best represented genus is *Cystoseira*, 9 species of which are recorded. The old names and notes on the labels are all given.

Nereocystis Luetkeana.§—T. C. Frye has studied this alga in its native habitat, and makes some interesting notes on it. The report of a

* Rhodora, viii. (1906) pp. 157–61.
† Nuov. Notar., xvii. (1906) pp. 151–61.
‡ Annali di Botanica, iv. (1906) pp. 262–7.
§ Bot. Gazette, xlii. (1906) pp. 143–6.

plant 90 m. in length he regards as incorrect, and quotes MacMillan's record of 80 ft. As to the question whether or not it is an annual, he says that, except for a few stragglers, all the plants noticed by him the previous summer had gone in March of this year. Young plants of 1·25–2·5 m. long, with bulbs 12–38 mm. in diameter, and fronds 30–90 cm. in length, were to be seen growing on the bottom, 3–9 m. under the water. They do not reach the surface the first year, but remain out of reach of waves, pushing rapidly up in the second season, only to die when winter overtakes them. The growth is very rapid, and the author calculates that it is as much as 25 cm. a day at one time. The stalk is firmly anchored to the rocks by holdfasts covering an area as much as 30 cm. in diameter.

Constantinea.*—W. A. Setchell has made a study of this genus, and comes to the following conclusions:—1. The genus *Constantinea* is to be restricted to the three species, *C. rosa-marina*, *C. simplex*, and *C. subulifera*. 2. Thus constituted, it is a genus of the Dumontiaceæ, as defined by Schmitz and Hauptfleisch; it is characterised by the possession of cylindrical, annulate, and more or less dichotomously branched stipes, bearing orbicular laminæ, at first peltate or nearly so, later perfoliate, entire, or more or less radiately split, and by the possession of nemathecia containing zonate tetraspores accompanied by unicellular paraphyses. 3. *C. rosa-marina* is identical with *C. sitchensis* P. and R. 4. The author founds his new species, *C. subulifera*, on the plant collected by Harvey in N.W. America, and named by him *C. sitchensis*. 5. The genus is confined to the Northern Pacific and Behring Sea. The separation of the species is clearly shown by means of an analytical key. The synonymy of the three species is detailed, with a list of exsiccatæ; and *C. subulifera* is described.

Cladophora crispata and the Section Ægagropila.†—F. Brand publishes the result of his further studies on *Cladophora*, and deals with the differences between the attached and the free-swimming forms. He shows that *C. fracta* is no independent species, but merely the free-swimming form of *C. crispata*. He gives an emended diagnosis of *C. crispata*, to which he reckons also *C. vitrea* Kutz., *C. regularis* Kutz., *C. virescens* Kutz., *C. brachyclados* Kutz., *C. putealis* Kutz., *C. brachystelecha* Rabenh., and *C. glomerata* var. *stagnalis* Brand ex parte. His former treatment of the section Ægagropila is supplemented by further remarks and a description of a new fresh-water species of the group which was found by Professor Lagerheim in a lake in the neighbourhood of Stockholm. Brand names the plant *C. Lagerheimii*; it is distinguished from all other species of the group by the occurrence on some of the filaments of pinnate branching. An amplified diagnosis is also given of *C. profunda* Brand. The difficulty of determination of species is realised by the author, and comparative tables are given of the habit and structure of *C. glomerata*, *C. crispata*, and *C. fracta*, as representing Eucladophora, and the group of Euægagropila. A valuable summary is given of the characters of fixed, as opposed to free-swimming, species. Plants

* Nuov. Notar., xvii. (1906) pp. 162–73.
† Hedwigia, xlv. (1906) pp. 241–59.

which begin life attached, change their characteristics when they become free-swimming.

Yorkshire Diatomaceæ.*—M. H. Stiles gives some lists of Yorkshire Diatoms gathered in 1905. These form a supplement to R. H. Philip's report in a previous number of the same journal. One of the lists is an enumeration of 31 species and varieties not previously recorded for Askern, among these being Philip's new variety of *Fragilaria capucina*, with a curious median inflation; this is figured as var. *inflata*. The other list comprises 64 species and varieties from a small hillside streamlet at Ilkley.

R. H. Philip † publishes notes on some Diatoms collected in the district round Hull in 1904–5. In all some 13 species or varieties were found which had not been previously recorded, and these are all figured. Ten of them are marine, and the rest came from fresh-water. The rare *Stephanopyxis turris* was found again in Ascidian molluscs. The plate is re-published in the "Naturalist" ‡ with an abstract of the paper.

R. H. Philip § gives lists of Diatoms collected in a pond in Boynton Woods (18 species) and in a stream falling into Little Thornwick Bay (18 species). In the lower part of this stream a marine species, *Coscinodiscus radiatus*, is very plentiful considerably above high-water mark. Only one other marine species was found. In ponds at Speeton a few species of Desmideæ occur in abundance.

Fossil Diatoms.‖—A. M. Edwards records the finding of 10 species of Bacillariæ in the rocks of the Hudson River Epoch of the Lower Silurian Age in New Jersey. All the species are identical with the Bacillariæ of the present day. He describes the method employed for the separation of the specimens from the rocks, and shows that it is impossible for them to have become introduced during the process of cleansing. They must therefore be fossil.

Polymorphism of Cyanophyceæ.¶—H. Royers shows that Meyen's new alga, *Listia crustacea*, from the Laacher See, is synonymous with *Rivularia minutula* Born. et Flah. It germinates from resting spores which are formed at the thick end of the plant, and the filaments with their false branching form a hemispheroidal green thallus, held together by tough gelatinoid matter. After dissolution of this thallus the individual threads become attached to submerged stones and grow in the form of a *Schizosiphon*. They reproduce themselves by means of hormogonia. They must not be confused with the *Scytonema*-forms which occur in the same place and are reproduced in the same manner. Under certain conditions pieces of the *Rivularia* become converted into a *Nostoc*-thallus, regarded by the author as being *Nostoc lichenoides* Vauch. In other circumstances, when associated with certain fungal hyphæ, the plant forms the lichen *Collema pulposum* var. *hydrocharum* Ach. A bibliography and illustrations are added.

* Naturalist, 1906, pp. 128–9 (1 fig.).
† Trans. Hull Sci. and Field Nat. Club, 1906, pp. 217–18 (1 pl.).
‡ Naturalist, 1906, p. 67. § Tom. cit., pp. 262–3.
‖ Nuov. Notar., xvii. (1906) pp. 174–80.
¶ Jahresb. Nat. Verein. Elberfeld, 1906, pp. 3–40 (3 pls.).

Reproduction of Stigeoclonium.*—A. Pascher describes phenomena connected with the reproduction of a species of *Stigeoclonium*, which is probably *S. nudiusculum*. In calm water there was observed a rich formation of hairs. By transferring material from disturbed to calm water, the author was able to bring about in every case the formation of swarm-spores. The reproductive bodies were either macrospores or microspores, which either became resting-spores, or formed zygotes, or were transmuted into aplanospores. Zoospores with two cilia and akinetæ stages, as well as the *Palmella* condition, seemed to be entirely wanting. From an examination of other species, the author finds that morphologically similar species of *Stigeoclonium* do not by any means always show similar forms of reproduction, or the same behaviour of the swarm-spores. Details of the spores, size, etc., are given of the material, regarded by the author as either *S. tenue* or *S. falklandicum*, on which some of his conclusions are based. Copulation was several times observed between the microspores.

Icelandic Plankton.†—C. H. Ostenfeld and C. Wesenberg-Lund publish an account of the plankton of two lakes—Thingvallavatn and Myvatn, in the south-west and north of Iceland respectively. The phytoplankton has been worked out by Ostenfeld, and the zooplankton by Wesenberg-Lund. In Myvatn, no phytoplankton was found at all, and in Thingvallavatn there were no plankton Myxophyceæ, and indeed the main interest of the algal collections lies in the non-occurrence of forms which one would have expected to find. The Diatoms constitute the main part of the species, and the commonest of these are the Melosiræ and *Asterionella formosa*. *Fragilaria crotensis* occurs very sparingly and only at the highest temperatures. The limnetic Chlorophyceæ are not abundant, and *Ceratium hirundinella* and *Dinobryon* are absent. Since the samples were collected regularly every fortnight during a whole year, the authors are able to draw conclusions of great value from the results of their examination. They think it probable that the plankton of the arctic lakes consists mainly of zooplankton, to a much greater degree than is the case with that of more southern countries; also that the phytoplankton, especially in summer time, only plays an insignificant part. In arctic and sub-arctic lakes it consists in all probability of algæ with yellowish or yellowish-brown chromatophores; algæ with green or blue-green chromatophores being almost entirely wanting. As exceptions to this rule may be mentioned *Sphærocystis*, the semi-limnetic Desmids, and a few rare Chlorophyceæ. The authors conclude their interesting paper by remarks on W. and G. S. West's "Freshwater plankton of the Scottish Lochs."‡ A list of literature is followed by two plates and a photograph of Thingvallavatn.

Griffithsia acuta Zan.§—G. B. de Toni has made a study of this alga, which was never described by its author, and the original specimen of which is preserved with the rest of Zanardini's herbarium in the

* Archiv Hydrobiol. u Planktonk., i. (1906) pp. 433–8.
† Proc. Roy. Soc. Edinburgh, xxv. (1906) pp. 1092–1197 (3 pls., figs. in text).
‡ Trans. Roy. Soc. Edinburgh, 1905, p. 477.
§ Comptes Rendus Assoc. Française pour l'Avancement d. Sci., 1905, pp. 402–5.

Municipal Museum at Venice. No fructification has been found, and it is therefore impossible to place the species with certainty in its right section of *Griffithsia*, though it probably belongs to *Acrocladia*. The original specimens do not exceed 3 cm. in length, and are irregularly dichotomous. Some of the branches have a tendency to form hooks such as are seen in *Hypnœa* and *Campylæphora*. A careful comparison of *G. acuta* with *G. furcellata* J. Ag. and with *G. Duriœi* Mont. brings the author to the conclusion that they are all the same species, *G. acuta* forming the connecting-link between the other two. They must now be known under the name of *G. furcellata* J. Ag. as being the oldest name. The nearest ally of this conjoint species is *G. setacea* Ag.

BREEMEN, P. J., VAN—**Bemerkungen über einige Planktonformen.** (Remarks on certain plankton forms.) *Verh. Rijksinst. Onderzoek. d. Zee*, i. (1906) 8 pp., plate.

MAZZA, A.—**Saggio di Algologia Oceanica.** (Essay on oceanic algology.)
[A continuation of this work, including the genera *Phyllophora*, *Stenogramma*, *Gymnogongrus*, *Ahnfeltia*, *Actinococcus*, *Colacolepis*, *Sterrocolax*, *Mychodea*, and *Dicranema*.]
Nuov. Notar., xvii. (1906) pp. 129–50.

NAMIKAWA, S.—**Fresh-water Algæ as an Article of Human Food.**
Bull. Coll. Agr. Tokyo, vii. (1906) p. 123.

RIDLEY, H. N.—**An Expedition to Christmas Island.**
[This paper includes a list of 22 marine algæ, identified by A. and E. S. Gepp, the notes upon which have been published in the "Journal of Botany." No algæ had been recorded previously from the island.]
Journ. Straits Branch R. Asiatic Soc., 1905, pp. 255–7.

Fungi.

(By A. LORRAIN SMITH, F.L.S.)

Fungus of Economic Importance.*—R. and E. Smith describe a new disease that attacks stored lemons, causing very great loss. It is a brown rot with a peculiar odour, and the writers have succeeded in isolating and cultivating the fungus that is the cause of the mischief. On the lemons it appears as a sterile mycelium, and in many of the culture media nothing else grew; but on soil, where a diseased lemon had lain, or on wet filter paper similarly affected, the spore stage developed abundantly. This was very much like *Pythium*: a fine septate branching mycelium with terminal sporangia containing swarm-spores. No indication of sexual reproduction was observed. The name *Pythiacystis citrophthora* g. et sp. n., has been given to the fungus by the authors, who consider it to be intermediate between Saprolegniaceæ and Peronosporeæ.

Cytology of the Entomophthoraceæ.†—Lincoln Ware Riddle has studied material of several species of *Entomophthora* and of *Empusa Grylli*, and he considers that the cytological evidence he has gained enables him to trace the descent of this family from a *Mucor* ancestor.

* Bot. Gazette, xlii. (1906) pp. 215–21.
† Proc. Amer. Acad. Sci., xlii. (1906) pp. 178–97 (3 pls.).

He finds such an ancestor in *Sporodinia*, where the resting spore, the zygote, is formed by the fusion of primitive cœnogametes with numerous nuclei, and where azygospores are frequent. He looks on the conidium of *Empusa* as a sporangium into which has been extended the cœnocytic habit. Apogamy has become constant in *Empusa*, resulting in the formation of multinucleate azygospores, as in *Sporodinia*. Thus from *Sporodinia* he traces the development of *Empusa*, *Entomophthora*, and *Basidiobolus*, indicating in each genus the points that establish his theory of descent.

Fungus Flora of Luxemburg.*—Joh. Feltgen published a preliminary account of the Ascomycetes for this flora. After his death in May 1904, his son, Ernest Feltgen, continued the work, and has published a further instalment. The substratum, locality, and date of growth are given in each case, and many new species are described. There are also included full descriptions of many rare forms.

Biology of Pyronema confluens.†—P. Kosaroff found that this fungus appeared constantly on burnt soil, and he made a series of culture experiments to determine the conditions favourable or unfavourable to its growth. He failed to induce growth on unsterilised soil, and concluded that there must be some poison in such soil which hindered the development of the fungus. Its frequent appearance on burnt ground must be due to the effects of heat and sterilisation, as charcoal alone was not sufficient to insure a growth.

Ergot.‡—E. Tschermak discusses the appearance and prevalence of this disease in cereals. The sclerotium makes its appearance in the flower whether fertilised or not. In rye-plants that have a prolonged flowering season (as in winter rye), the number of infected plants tends to be much greater than in those with quick flowering. In barley the naked varieties suffer more than those with glumes. The conditions of moisture and temperature at the flowering period have much to do with the spread of the fungus. In a dry season and on dry soil, the time of flowering passes quickly, and the risk of infection is correspondingly diminished.

Production of Stable Yeasts from Fungi.§—G. Odin, who had already produced yeasts from *Penicillium* and *Coremium*, has continued his experiments with other fungi—*Sterigmatocystis versicolor* and *Aspergillus fumigatus*. He obtained the yeasts by cultivating the spores of the fungi in a sugar solution contained in a sealed chamber. The yeasts so developed were transferred to carrot or potato, and did not revert to the filamentous condition. He tested the effect of the yeasts of *A. fumigatus*, which is known to be pathogenic on rabbits, etc., and found that they retained unimpaired the pathogenic properties of the parent stock.

* Beilage Ber. Ver. Luxemburger Natur., xv. (1905). See also Bot. Centralbl., cii. (1906) pp. 197–8.

† Arb. k. Biolog. Anst. Land. Forstw., v. (1905) p. 126. See also Ann. Mycol., iv. (1906) pp. 375–6.

‡ Fühling's Landw. Zeit., lv. (1906) pp. 194–9. See also Ann. Mycol., iv. (1906) pp. 369–70.

§ Comptes Rendus, cxliii. (1906) pp. 468–70.

North American Species of Peridermium.*—J. C. Arthur and F. D. Kern describe 27 species of *Peridermium*. As understood by them, the genus includes all *Æcidia* possessing peridia, inhabiting the Pinaceæ and Gnetaceæ. Only three of the species have been definitely connected with other growth-forms, but from the structure of the *Æcidia* they are able to determine the genus to which they will probably be found to belong. There are seven of these genera: *Coleosporium*, *Cronartium*, *Pucciniastrum*, *Calyptospora*, *Melampsorella*, *Melampsoridium*, and *Chrysomyxa*. Several new species are given by the authors, and keys are drawn up of the hosts as well as of the parasites.

Hyphomycetes.†—Lindau began, in fascicle 98, the description of the large parasitic genus *Ramularia*, which is continued through the following fascicle and on to p. 532 of part 100. It is a leaf disease causing spots which are disfiguring even when not greatly harmful. Several new species are described. The Hyalohelicosporæ and the Hyalostaurosporæ conclude the Mucedineæ. The first section of the Dematiaceæ with simple brown spores is begun. As in previous numbers, the genera and some of the species are illustrated in the text.

In part 101‡ he continues the description of the Torulæ. The principal genera dealt with are *Torula*, *Hormiscium*, and *Gyroceras*. Some new species are described by the author. The Echinobotryeæ and Periconieæ are also described, and the Arthriniæ are begun. Keys to the genera head the different chapters. The illustrations, as usual, are abundant and clear.

Fungus Parasitic on Elodea.§—Werner Kegel describes an unusual form of Hyphomycete, which he names *Varicosporium Elodeæ*, and which he found constantly infesting plants of *Elodea*. The conidia are elongate septate, and are borne in acropetal succession but at right angles to each other, so that a confused branching system of conidia is formed. He found also pycnidia, but could not connect the two fungi together.

Australian Rusts.‖—D. McAlpine contributes a further list of hosts for the new Uredineous genus *Uromycladium*. The genus is confined to acacias, and the rusts grow usually on the phyllodes. The list also includes the species of *Uromyces* within the same genus of host-plants. McAlpine describes a new *Æcidium*, the first to be detected on any acacia in Australia. It grows on the shoots and fruits of *Acacia farnesiana*, and is recorded from Queensland and West Australia.

Infection Experiments with Ustilago Carbo.¶—Nazareno Strampelli has followed up Hecke's account of the propagation of the smut of cereals by a series of inoculation experiments carried out with every precaution as to sterilisation and protection during growth. Those plants that were inoculated with smut spores at the time of flowering, became completely carbonised; others, that were grown as control

* Bull. Torrey Bot. Club, xxxiii. (1906) pp. 403–38.

† Rabenhorst's Kryptogamen-Flora, i. Abt. 8, Lief. 99 (Leipzig, 1906) pp. 433–512; Lief. 100, pp. 513–76.

‡ Op. cit., Lief. 101 (Leipzig, 1906) pp. 577–640.

§ Ber. Deutsch. Bot. Gesell., xxiv (1906) pp. 213–16.

‖ Ann. Mycol., iv. (1906) pp. 322–6.

¶ Atti Reale Acad. Lincei, ccciii. (1906) pp. 211–13.

cultures, and that were protected from all spore contamination, remained healthy.

Corn Smuts and their Propagation.*—T. Johnson writes a popular account of the various smuts. He sketches the history of our knowledge of these organisms, and of the works published concerning them by the brothers Tulasne, Kühn, and Brefeld. The latter writer discovered quite recently that smut infection of oats takes place when the host is a seedling; in the case of wheat and barley, it is the flower that gives entrance to the fungal pest. In Indian corn any young tissue is liable to attack. The best methods of cure for the different types of smut are described.

Abnormalities in Agarics.†—E. Tobias writes on the abnormal forms assumed by various fungi, as, for instance, when a "cap" turned upside down is borne on another. He explains the occurrence thus: that the two plants grew close together and the stronger tore the weaker from its base and carried it up.

Form Development in Agarics.‡—Werner Magnus has devoted much attention to the study of this subject. He has made observations on the growth and expansion of the normal plants, and he has tested the power of recuperation of the various parts by wounding the tissues, or cutting off the different organs and then watching further growth. Shortly before the period of expansion he found that the function of each part was determined, and if that part was cut away it did not grow again. He tested the vegetative power of growth of isolated hyphæ, and found that they grew in a nutritive solution or in distilled water from almost any part of the organism. He discusses also the instances of teratological formations, the most frequent of which is the doubling of the fruit-body. He records instances of monstrosities, and gives his views as to their origin. The phylogenetic problem is also reviewed, with reference to the growth and form of the hymenium, etc.

New Belgian Gasteromycete.§—Ch. Van Bambeke describes the somewhat rare *Pisolithus arenarius* Alb. and Schwein., which has recently been found growing in Belgium. He describes the fungus, which is usually found growing on sandy soil, and gives the distribution of the species, rather a wide one; it is rare in Europe and America, but fairly common in Australia.

Mycological Notes.‖—C. G. Lloyd has recently issued two numbers of his "Notes." The first, almost wholly written in French, gives an account of some of the more rare Gasteromycetes, *Arachnion album*, species of *Bovistella*, *Battarrea*, *Calvatia*, *Lycoperdon*, etc. The writer thinks that European botanists have not given sufficient attention to this group of fungi. He records a new genus, *Whetstonia*, from Minnesota. The gleba consists of spores contained in persistent cells;

* Science Progress, i. (1906) pp. 137–49.

† Zeitschr. Nat Abt. Deutsch. Gesell. Kunst. u. Wiss. Posen, xii. (1906) p. 79 (figs.). See also Bot. Centralbl, cii. (1906) p. 256.

‡ Berlin: R. Friedländer & Sohn, 1906, 161 pp. (6 pls.).

§ Bull. Soc. Roy. Bot. Belg. xlii. (1906) pp. 178–83 (1 pl.).

‖ Mycological Notes, Nos. 22 and 23 (Cincinnati, 1906) pp. 261–92 (5 pls.).

capillitium none. The second number is devoted to a consideration of the genus *Bovistella*, with diagnoses and notes on the species. There are also remarks on some rare Australian fungi, and an account of botanical work at Geneva.

Tylostomeæ.*—C. G. Lloyd continues his study of Gasteromycetes, and has recently published an account of the Tylostomeæ. This family includes the genera *Queletia*, *Dictyocephalos*, *Schizostoma*, *Battarrea*, *Battarreopsis*, *Chlamydopus*, and *Tylostoma*. The last mentioned is by far the largest genus, though only one British species is included in it. The plants of this family are, with a few exceptions, of very rare occurrence. Some of the genera are founded on a species that has been collected only once. Lloyd writes descriptions and notes on each of the species, and they are all illustrated by photographic reproductions.

Mycorhiza-producing Fungus.†—The fungus in question—*Cortinarius rubipes* sp. n.—has been described by C. H. Kauffman. It is distinguished by its brick-red mycelial strands and stem. The colour of the mycelium made it possible to trace its course in the soil, and it was found that it was attached as an ectotrophic mycorhiza to red oaks, a sugar-maple, and to *Celastrus scandens* which wound round one of the oaks. The fungus was curiously selective; in the case of *Celastrus*, it neglected the oaks to attach itself to that plant. Some other trees in the vicinity were also ignored. The writer presumes that "it is dependent for its initial attachment on certain environmental factors."

Notes on various Fungi.‡—G. Bainier records work done recently at the School of Pharmacy. Several species of *Penicillium*, *P. Costantini*, *P. rufescens*, and *P. patulum*, are described and compared. He cultivated the mould, *Helicostylum elegans*, and found that so many differences were present that it was necessary to remove the plant to another genus, *Chætostylum*. Notes and observations are also published on *Dispira cornuta*, the genus *Cœmansia*, and a new species of Hyphomycete, *Acrostalagmus nigripes*, so named from the black colour of the stalk, the verticils and conidia being colourless.

Economic Use of Fungi.§—R. Reissinger calls attention to the use made of the green-coloured wood which is permeated by the fungus *Peziza æruginosa*. He proposes to increase the quantity by growing the fungus on beech wood.

New Fungus Stain.‖—F. Guéguen recommends Sudan iii. dissolved in lactic acid as a coloration of the oily substances in fungi. He gives careful descriptions as to the preparation and employment of that and other stains for fungi. Sudan iii. is useful also in the examination of Lichens, and even in the histological study of the higher plants.

* Cincinnati, U.S.A., 1906, 28 pp., 12 pls. and 6 figs.
† Bot. Gazette, xlii. (1906) pp. 208–14.
‡ Bull. Soc. Mycol. France, xxii. (1906) pp. 205–23 (5 pls).
§ Nat. Zeitschr. Land. Forstw., iv. (1906) pp. 164–6. See also Bot. Centralbl., cii. (1906) p. 280.
‖ Bull. Soc. Mycol. France, xxii. (1906) pp. 224–6.

Notes on Cases of Poisoning by Fungi.*—These notes are contributed by M. Boué and M. Demange. Boué experienced symptoms of poisoning after eating *Amanita junquillea*. Demange made inquiries as to harmful fungi in Tonkin, and found that the species in question was *Hygrophorus conicus*. Of six persons attacked, four died from the effects of the poison; two others responded to treatment and recovered.

Outlines for the Observation of some of the more Common Fungi.†G. F. Atkinson gives directions to beginners in mycology for the collection and study of various fungi. The present part deals with poisonous and edible Agarics, Polyporei, Clavariæ, and some Ascomycetes.

Spread of Fungus Diseases by means of Hibernating Mycelium.‡ A paper on this subject has just been issued from Kew. Well-known cases of hybernating mycelium are cited, such as potato disease which is carried over in the tubers, darnel grass, and others. An account is given of experiments proving the influence of weather and temperature on the spread of fungus diseases: potato tubers infected by *Phytophthora* were planted in pots and kept, some in damp warm conditions, others in a dry cool atmosphere. The latter showed no sign of disease after many weeks; the former had all succumbed sooner or later. The writer insists on the danger of using seed, tubers, bulbs, etc., produced in an infected area, in the case of plants known to be capable of perpetuating a disease by means of hybernating mycelium.

American Mycology.§—W. A. Kellerman gives an account of a botanical trip to Central America for the purpose of collecting parasitic fungi. He describes the climate, topography, vegetation, etc., of the different places visited, indicating where fungi were most prevalent. A list of fungi is promised.

Vera K. Charles‖ has found that a disease of *Theobroma*, which resulted in the rotting of the pods, was due to *Lasiodiplodia*, probably *L. tubericola*, but that is not yet ascertained.

G. G. Hedgcock and Percy Spaulding¶ have invented a method of mounting microscopic fungi for the herbarium. They are grown on agar-agar; the culture is then transferred to a card and allowed to dry, and finally covered with a perforated piece of cardboard of varying thickness.

J. C. Arthur** desires a new classification of the Uredinales. He claims that the various stages in the life-cycle should be recognised in nomenclature, and points out the anomaly of ignoring the *Æcidium*, which is the sexual stage.

A. P. Morgan†† commences an account of the North American species of *Lepiota*, of which some 80 species have been enumerated. Morgan gives diagnoses of 12 species.

The same writer‡‡ publishes "Descriptive Synopses of Morgan's

* Bull. Soc. Mycol. France, xxii. (1906) pp. 227–32.
† Plant World, viii. (1905) pp. 245–55.
‡ Journ. Board Agric., xiii. (1906) pp 257–64.
§ Journ. Mycol., xii. (1906) pp. 137–45.
‖ Tom. cit., pp. 145–6.
¶ Tom. cit., p. 147.
** Tom. cit., pp. 149–54.
†† Tom. cit., pp. 154–9.
‡‡ Tom. cit., pp. 159–62.

North American species of *Marasmius*," and the synopsis to North American species of *Heliomyces*. Articles on these genera were previously published.

Field notes * on the Uredineæ are contributed by A. O. Garrett. The species described were collected some thirty miles from Salt Lake City.

Italian Fungi.†—Teodoro Ferraris publishes a first instalment of a projected list of fungi for Piedmont, which he has been preparing and arranging during the years 1901–6. He records 289 species, a few of which are new to science.

C. Massalongo‡ states that since the publication of the Veronese flora in 1902, a considerable number of additions have been made to the fungi, and he publishes a list of these, 82 in number. Several are new species, and diagnoses of these are given.

Plant Diseases.§—E. Zederbauer describes the canker of pine-trees caused by *Dasycypha calyciformis*. It enters the tree by wounds caused by injury to the bark or by breaking of branches, etc. Infection appears first in the soft bast, from which it spreads both to the wood and the cortex.

E. Mead Wilcox ‖ gives an account of diseases that have affected fruit trees in Alabama. He classes them under the plants attacked, beginning with apple, and describing the various rots, cankers, blights, etc. The latter pages of the bulletin are devoted to an account of fungicides, their preparation, and methods of applying them.

In another paper¶ Mead Wilcox takes up the diseases of sweet potato—black and dry rot, scurf, etc.—all due to various forms of fungi.

A. Stift ** records the damage done to plants in Hungary during the year 1905 both by insects and by fungi. He notes the occurrence of *Gymnosporangium Sabinæ*, *Æcidium Grossulariæ*, and *Phyllosticta fragaricola*.

Arsenio Puttemans †† gives an account of the cultivation of lucerne in the state of S. Paulo. It is found that in that region it lasts only three years instead of ten or fifteen years as in the Argentine Republic. The author thinks that its disappearance is due at least in part to the action of various fungal parasites, of which he gives a descriptive list. These are difficult to eradicate, but advice is given as to methods of cultivation that will strengthen the lucerne and render it less liable to disease.

Puttemans ‡‡ publishes another paper on a disease of haricots in

* Journ. Mycol., xii. (1906) pp. 162–4.

† Malpighia, xx. (1906) p. 125–58.

‡ Tom. cit., pp. 159–70.

§ Centralbl. Gesamte Forstw., i. (1906) 5 pp., 4 photographs. See also Hedwigia, xlv. (1906) Beibl., p. 142.

‖ Bull. Alabama Agric. Exper. Station, No. 132 (1905) 142 pp. 9 pls.

¶ Op. cit., No. 135 (1905) 16 pp., 4 figs.

** Oesterr.-ungar. Zeitschr. Zuckerind. Landw., 1906, p. 28. See also Centralbl. Bakt., xvi (1906) pp. 748-50.

†† Rev. Agric., Nos. 119-121 (S. Paulo, 1905) 23 pp., 17 figs. See also Bot. Centralbl., cii. (1906) p. 199.

‡‡ Op. cit., No. 130 (1906) pp. 200–4 (3 figs.). See also Bot. Centralbl., cii. (1906) p. 227.

Brazil caused by a fungus *Tsariopsis griseola*. It forms brown polygonal patches on the leaves and also on the pods. The damage is often increased by the presence of *Erysiphe communis* and *Uromyces appendiculatus*.

The same writer* has also given his attention to the rust of cereals in S. Paulo, where it is very frequent. The species found there is *Puccinia rubigo-vera* and not *P. graminis*. He explains the absence of the latter by the long distance, which the uredospores are unable to traverse, and by the unfavourable conditions for the germination of the teleutospores (absence of low temperatures and want of *Berberis*); *P. coronata* is common on oats, and does great damage; *P. Sorghi* is also found at S. Paulo, but is comparatively harmless.

Wm. Stuart † has experimented with potatoes to find disease-resisting varieties. Those of an upright habit, with firm, hairy, medium-sized leaves were found to be most resistant. Some hybrids showed high resistance to disease, but with slight formation of tubers, and were valuable only to hybridise with well-known cultivated varieties.

F. W. Neger ‡ describes the ravages of *Dermatea carpinea*, a wound-parasite on the beech-trees. It establishes itself on dead branches and passes into the living parts of the tree, which it destroys. The spores are disseminated by damp winds. Neger produced the conidial-form in artificial cultures.

A leaflet § has been issued with information concerning the Tree-root rot (*Armillaria mellea*). It attacks almost any kind of tree, travelling along the ground as rhizomorphous strands. Instructions are given for detecting the fungus, and for the best way of eradicating it.

BANKER, H. J.—**A Contribution to a revision of the North American Hydnaceæ.**
[The writer introduces two new genera, *Leaia* and *Grandinoides*.
Bull. Torrey Bot. Club, xii. (1906) pp. 99–194.
See also *Bot. Centralbl.*, cii. (1906) pp. 331–2.

DIETEL, P.—**Beschreibungen einiger neuer Uredineen.** (Description of some new Uredineæ.)
[The species are from India, Japan, America, etc.]
Ann. Mycol., iv. (1906) pp. 303–8.

FAIRMAN, CHARLES E.—**New or Rare Pyrenomycetæ from Western New York.**
[Most of the species described are new to science.]
Proc. Roch. Acad. Sci., iv. (1906) pp. 215–24 (3 pls.).

" " **Pyrenomycetæ novæ in leguminibus Robiniæ.** (New Pyrenomycetes on the pods of *Robinia pseudacacia*.)
[Fairman describes five new species.]
Ann. Mycol., iv. (1906) pp. 326–8 (4 figs.).

* Ext. de Annuario Esc. Polyt. (S. Paulo, 1905) 20 pp., 10 figs. See also Bot. Centralbl., cii. (1906) p. 226.
† Vermont, Agric. Exper. Stat., Bull. cxxii. (1906) pp. 107–36. See also Bot. Centralbl., cii. (1906) p. 199.
‡ Tharandter Forstl. Jahrb., lvi. (1906) pp. 49–62. See also Bot. Centralbl., cii. (1906) pp. 338–9.
§ Board of Agric. and Fish., Leaflet No. 174 (1906) 3 pp. (1 fig.).

GLATFELTER, N. M.—**Preliminary List of Higher Fungi collected in the Vicinity of St. Louis from 1898–1905.**
[About 500 Basidiomycetes are included in the list; a number of them are described as new species.] *Trans. Acad. Sci. St. Louis*, xvi. (1906) pp. 33–94.
See also *Bot. Centralbl.*, cii. (1906) p. 198.

HASELHOFF, E., & MACH, F.—**Ueber die Zersetzung der Futtermittel durch Schimmelpilze.** (The destruction of fodder stuffs by fungi.)
[*Aspergillus* and *Penicillium* destroy the fat of rice meal.]
Mitt. Landw. Versuch. Marburg Landw. Jahrb., 1906, pp. 445–65.
See also *Bot. Centralbl.*, cii. (1906) pp. 309–10.

HARIOT, P., & PATOUILLARD, N.—**Note sur le genre Colletomanginia.** (Note on the genus *Colletomanginia.*)
[A full description is given, and several figures to illustrate this new African fungus.] *Bull. Soc. Mycol. France*, xxii. (1906) pp. 201–4 (1 pl. and 2 figs.).

MAIRE, RÉNÉ—**Notes Mycologiques.**
[Notes and descriptions of new or rare species, mostly of microfungi.]
Ann. Mycol., iv. (1906) pp. 329–35 (1 fig.).

MATSUMURA, J.—**Index Plantarum Japonicarum.** (Index of Japanese plants.)
[Fungi and lichens are included in the list.]
Maruzen (Tokio, 1906) pp. 127–221 and 365–8.

PATOUILLARD, N.—**Champignons Algero-Tunisiens nouveaux ou peu connus.** (New or little known fungi from Algiers and Tunis.)
[A number of new species are described.]
Bull. Soc. Mycol. France, xxii. (1906) pp. 195–200 (4 figs.)

PECK, C. H.—**New Species of Fungi.**
[The new species are from various parts of American territory.]
Bull. Torrey Bot. Club, xxxiii. (1906) pp. 213–21.

POLLOCK, J. B., & KAUFFMANN, C. H.—**Michigan Fungi.**
[A continuation of a previous list by Longyear, chiefly microfungi.]
Rep. Michigan Acad. Sci., vii. (1905) pp. 57–67.

RAYNER, J. F.—**A List of the Fungi of the New Forest.**
H. M. Gilbert and Son, Southampton and Winchester, 1906, 22 pp., 2 pls.

REHM, H.—**Ascomycetes novi.**
[New Ascomycetes of North America, France, Greece, and South Africa.]
Ann. Mycol., iv. (1906) pp. 336–41.

RICK, J.—**Fungi Austro-Americani, Fasc. iii. et iv.**
[Nos. 43–80 are listed; several new species are added.]
Tom. cit., pp. 309–12.

„ **Pilze aus Rio Grande do Sul.**
[New species of Basidiomycetes, Gasteromycetes, and Ascomycetes are described.] *Broteria*, v. (1906) 53 pp., 6 pls.
See also *Ann. Mycol.*, iv. (1906) pp. 361–2.

SCHULZE-WEGE, JOHANNA—**Verzeichnis der von mir im Thüringen gesammelten und gemalten Pilze.**
[Catalogue of fungi collected in Thuringia, and printed by the author.]
Mitth. Thür. Bot. Ver., xx. (1904–5) pp. 63–8.
See also *Bot. Centralbl.*, cii. (1906) p. 229.

SYDOW, H. & P.—**Novæ Fungorum Species. III.**
[These new fungi are from widely separated regions; there is one new genus, *Botryoconis* (Melanconiaceæ).
Ann. Mycol., iv. (1906) pp. 343–5.

URSPRUNG, A.—**Ueber den Bewegungsmechanismus des Trichia Capillitiums.** (On the movement mechanism of the *Trichia* capillitium.)
[The author discusses the movements and the changes in the capillitium.]
Ber. Deutsch. Bot. Gesell., xxiv. (1906) pp. 216–22.

WILL, H.—**Beiträge zur Kenntnis der Sporspilze ohne sporenbildung, Welche in Brauereibetrieben und deren Umgebung vorkommen.** (Contributions to the knowledge of yeast-fungi, without spore-formation, which occur in brewing industries.)

[Several species of *Saccharomyces* are described.]

Centralbl. Bakt., xvii. (1906) pp. 1–7.

Lichens.

(By A. LORRAIN SMITH.)

French Lichens.*—E. Monguillon publishes a supplement to his Catalogue of Lichens for the Department of Sarthe. He gives a list of 200 species, half of them being new for the district. The others are published with additional localities. The number of rare species is notable.

Relation of Lichens to Trees and Soil.†—Von Tubeuf finds that the smooth, bright bark of the Weymouth pine becomes dull black, uneven and bumpy under growths of lichens such as *Xanthoria parietina* and *Parmelia*. The bumps are largest towards the centre of the growth, and are covered with small cracks. Microscopic examination showed an increase of cellular growth at these points which had burst the epidermis. He attributes this to the retention of water. A covering of moist cotton wool produced the same effect on healthy branches.

In discussing the growth of mosses and lichens in the pine woods, E. Zederbauer ‡ finds that *Cladonia pyxidata* and *Peltigera horizontalis* grew only on ground that had been cleared of leaves. Lichens grew more plentifully on trees where there was thick planting. In those places the growth of the bark was slow, and the trees were sometimes quite surrounded by lichens.

British Cœnogoniaceæ.§—A. Lorrain Smith finds that the two genera belonging to this order are both represented in Britain. *Racodium rupestre*, of which the symbiotic alga is a *Cladophora*, has been found in several localities. *Cœnogonium germanicum* is more frequently met with; it is associated with *Trentepohlia aurea*. Neither of these plants has been found in fruit. The writer traces the history of these plants in botanical literature where they have been described as *Byssus nigra*, *Cystocoleus ebeneus*, or *Racodium rupestre*, and the two plants have been constantly confused. A description is given of each, and measurements of various specimens of *Cœnogonium germanicum*.

Anatomy of Collema.‖—Abbé Hue finds three types of structure among the species of *Collema* he has examined. (1) The hyphæ become vertical towards the surface, anastomose more frequently, and so form a rudimentary cortex. (2) At the summit of the vertical hyphæ one or

* Bull. Acad. Internat. Géogr. Bot., 1906, 30 pp. See also Bot. Centralbl., cii. (1906) p. 312.

† Nat. Zeitschr. Land. Forstw., i. (1906). See also Centralbl. Bakt., xvi. (1906) p. 753.

‡ Mitth. k.k. Forstl. Ver. Mariabrunn. Wien: Wilhelm Frick, 1906, 13 pp., 9 figs. See also Bot. Centralbl., cii. (1906) pp. 129, 130.

§ Journ. of Bot., xliv. (1906) pp. 266–8.

‖ Journ. de Bot., xx. (1906) pp. 5–18.

two of the cells become larger, and a more advanced type of cortex results. (3) A true cortex is formed by the terminal cells of these hyphæ becoming rounded off as well as larger and by sending out short branches, the whole forming a kind of plectenchyma. The development of the fruits is also traced, and detailed descriptions given of five new species and of several varieties.

Cladonias in the Islands of the North Sea.* — M. Sandstede follows Nylander and Wainio in his study of this lichen genus. In the introduction he gives the characters which distinguish the species and forms of the genus. Each species is described and critically compared with the plants from the different exsiccatæ. The islands proved to be less rich in species than the mainland, but several additions were made to the flora, and three new varieties are described.

Notes on Cladonia.†—Bruce Fink continues his descriptive and critical notes on American species of *Cladonia*. He finds that *Cladonia subcariosa* differs from *Cl. cariosa* in having larger squamules and less fissured and carious podetia. *Cl. mitrula* and *Cl. leptophylla*, which are also passed under review, are very near to each other, but are distinguished by the smaller squamules and podetia of the latter. They both grow usually on soil.

"Chemical Tests" in Determining Lichens.‡ — The late Dr. William Nylander found that the tissues of lichens reacted differently, according to the species, to the application of various chemical solutions. These were chiefly potassium hydrate and calcium hypochlorite. Since his day, opinions have differed as to the diagnostic value of these tests. G. K. Merril sums up the evidence for and against their employment. Most of the American lichenologists have pronounced against their use. Merril himself considers them of great use in the determination of species, and in this matter he is in harmony with workers on the Continent at the present day.

ERICHSEN, E.—**Beiträge zur Flechtenflora der Umgegend von Hamburg und Holsteins.** (Contributions to the lichen flora of the neighbourhood of Hamburg and Holstein.)
[The list includes 300 species from a somewhat small area.]
Verh. Nat. Ver. Hamburg, xiii. (1905) pp. 44–104.
See also *Ann. Mycol.*, iv. (1906) p. 380.

HERRE, A. W. C. T.—**The Foliaceous and Fruticose Lichens of the Santa Cruz Peninsula, California.** *Proc. Wash. Acad. Sci.*, vii. (1906) pp. 325–96.
See also *Ann. Mycol.*, iv. (1906) pp. 380·1.

HESSE, O.—**Beitrag zur Kenntnis der Flechten und ihrer charakteristischen Bestandteile.** (Contribution to the knowledge of lichens and of their characteristic constituents.)
[A study of the chemical constitution of *Usnea*, *Alectoria*, *Cetraria*, and others.] *Journ. Prakt. Chemie*, n.f. lxxiii. (1906) pp. 113–76
See also *Ann. Mycol.*, iv. (1906) pp. 381–2.

HOWE, REG. HEBER, JUN.—**Lichens of Mount Monadnock, New Hampshire.**
[A list is given of 71 species, with the habitat.]
Amer. Nat., xl. (1906) pp. 661–5.

* Abh. Nat. Ver. Bremen, xviii. (1906) pp. 384–456 (4 pls.). See also Bot. Centralbl., cii. (1906) pp. 121-2.
† Bryologist, ix. (1906) pp. 57–60 (1 pl.). ‡ Tom. cit. pp. 60–71.

ZAHLBRÜCKNER, A.—**Lichenes rariores exsiccati. Decades vii., viii.**
[The species issued belong to very varied genera.]
Vienna, 1906. See also *Ann. Mycol.*, iv. (1906) pp. 382–3.

" " **Beitrag zur Flechtenflora Kretas.** (Contribution to the fungus flora of Crete.)
[The list includes 89 species. It corresponds fairly well with the flora of the Grecian mainland.
SB. k. Akad. Wiss. Wien. Math.-Nat. Kl., cxv. (1906) pp. 502–23. See also *Ann. Mycol.*, iv. (1906) p. 383.

" " **Neue Beiträge zur Flechtenflora des Possenyer Komitates.** (New contributions to the lichen flora of the Possenyer country.)
[The conditions of the country round the Carpathians are described, along with the lists of lichens new to the neighbourhood or to science.]
Verh. Ver. Nat. Heilk. Presszburg, xxv. [1904] (1905) pp. 119–31. See also *Ann. Mycol.*, iv. (1906) p. 383.

" " **Die naturlichen Pflanzenfamilien Ascolichenes.**
[An account of lichens including *Cladoniæ*, some of the crustaceous forms, and a large part of the group of lichens associated with blue-green algæ.]
Engler und Prantl, Lief. 225, pp. 145–92. Leipzig, Wilhelm Engelmann, 1906.

ZOPF, W.—**Zur Kenntnis der Flechtenstoffe.** (The knowledge of lichen constituents.)
[A large number of lichens have been examined, and their products described.] *Liebig's Ann. Chemie*, cccxlvi. (1906) pp. 82–127. See also *Ann. Mycol.*, iv. (1906) pp. 384–5.

Schizophyta.

Schizomycetes.

Bacillus flavo-aurantiacus sporogenes.*—W. N. Klimenko has isolated from Lisle's antisyphilitic serum a bacillus that forms spores, and stains by Gram's method. It coagulates milk, producing an acid reaction; it forms orange-yellow colonies on mannite agar, yellow colonies on simple agar; it exhibits a brownish-yellow pigment when grown on potato; it is not pathogenic for animals. The organism is a long motile bacillus with rounded ends, and 10–20 flagella distributed over the surface. The spore is oval and usually central. The optimum temperature is 37° C. When grown on gelatin the medium is liquefied; broth is at first clouded, but later a fine pellicle forms at the surface, and there is a slimy yellow deposit; old broth cultures have a cheesy odour; on Petruschky's medium after 24 hours there is a production of acid, but later (72–96 hours), it shows an alkaline reaction. Media containing methylen-blue are not decolorised; there is no formation of indol.

Spirillosis of Fowls.†—Levaditi and Manouglian find that the *Spirillum gallinarum*, the parasite of "septicémie brésilienne" described

* Centralbl. Bakt., 1te Abt. Orig., xlii. (1906) p. 221.
† Ann. Inst. Pasteur., xx. (1906) p. 593.

by Marchoux and Salimbeni, is not confined to the vascular system, but invades the glandular tissues and enters into contact with the various cellular eléments, though it does not appear to penetrate the protoplasm of the cells. The crisis that terminates the spirillar infection is caused by the phagocytosis of the spirilla by the macrophages of the spleen and liver. The authors find that this spirillum is able to infect the ovule of the animal.

Microbe of Whooping-Cough.* — J. Bordet and O. Gengou, by means of their special blood agar medium,† have isolated from the expectoration of early cases of whooping cough a small ovoid bacillus, much resembling the influenza bacillus, staining more deeply at the contour and at the ends, and not staining by Gram's method. The organism is unlike *B. influenzæ* in its inability to develop on the ordinary media, and has a much less tendency to produce involution forms. Serum tests served to demonstrate the specific nature of the bacillus, and to confirm it as the causative element of whooping-cough.

Experimental Production of Transmissible Varieties of B. tuberculosis and of Antituberculous Vaccine.‡—S. Arloing, after referring to his previous experiments by which he succeeded in establishing by a process of selection, a constant strain of human *B. tuberculosis* of lowered virulence, notes that by sub-culturing this organism in broth at gradually increasing temperatures, he was able to obtain a constant variety of *B. tuberculosis* that grew at 43°–44° C., and possessed a markedly lowered pathogenicity, and he employed this organism successfully for antituberculous vaccination.

Fibrillar Structure of Bacteriaceæ.§—J. Kunstler and C. Gineste find that, besides the vesicular elements of the parenchyma and the longitudinal striation of the tegument, which are doubtless of a special fibrillar nature, there is observable in the parenchyma of Bacteriaceæ certain characteristic figures that suggest a possible fibrillar constitution. From observations on *Spirillum periplaneticum* (a spirillum parasitic on *Periplaneta americana*), the authors noted the fundamental arrangement of these figures, the aspect of which differed with the age of the individual and with the optical plane studied, the general appearance being that of a trabecular network traversing the parenchyma of the cell.

Spirochætæ of Balanitis and of the Mouth.‖—E. Hoffmann and S. v. Prowazek find that the so-called flagella of *Spirochæta pallida* Schaudinn occurs also with other varieties of Spirochætæ—e. g., those of balanitis and of the mouth. The structure is not of the nature of a bacterial flagellum, but is, as is well demonstrated in *Spirochæta buccalis*, a continuation of the cell-protoplasm (periplast).

Morphology of Vibrio choleræ asiaticæ.¶—H. Hammerl, referring to the various forms the *Vibrio choleræ* assumes under different surrounding conditions, considers that the appearances are to be regarded

* Ann. Inst. Pasteur, xx. (1906) p. 731.
† See this Journal, 1906, p. 727.
‡ Comptes Rendus, cxlii. (1906) p. 1395. § Op. cit., clxiii. (1906) p. 84.
‖ Centralbl. Bakt., 1te Abt. Orig., xli. (1906) p. 817.
¶ Op. cit., xlii. (1906) p. 1.

not as results of involution and degeneration, but as due to physiological variations in the permeability of the body-membrane of the organism.

Disease of Guinea-pigs that resembles Plague.*—K. Byloff has isolated from guinea-pigs a bacillus that produces symptoms and morbid appearances resembling those of bubonic plague. The organism is very slightly motile, and a single flagellum was demonstrated by Zettnow's method. The site of infection is in the digestive tract, a general infection spreading hence by the blood and lymph channels. The bacillus should be classed with the bacteria of hæmorrhagic septicæmia.

The author contrasts this organism with *B. pseudotuberculosis* of other writers, and has named it *B. pestis intestinalis caviæ.*

Bi-polar Staining of the Plague Microbe.†—N. v. Westenrijk finds that the superficial layers of an agar culture of this organism show mostly cocco-bacillary forms with marked bi-polar staining, the deeper layers showing bacillary forms mostly uniformly stained or showing vacuoles. After cultivating the organism in atmospheres of hydrogen, carbonic dioxide, and oxygen, the author considers that the variation in form and staining reaction is due to the abundance or otherwise of oxygen. The vacuolation of the microbe is the result of its metabolism, and is dependent and proportional to it. The bi-polar staining is the result of a physiological plasmolysis.

Action on Bacteria of Electrical Discharges.‡—A. G. Foulerton and A. M. Kellas have shown that when bacteria suspended in water are exposed in an atmosphere of air or of pure nitrogen, to the action of electrical discharges of high potential and rapid frequency, sufficient quantities of nitrous and nitric acids are taken up in the solution within fifteen minutes to sterilise the emulsion. If the discharge takes place in an atmosphere of hydrogen, or carbonic dioxide, or carbonic monoxide, sufficient peroxide of hydrogen is formed after a time to exercise a distinct germicidal action. In no case did the authors find any evidence that under the time conditions, the electrical current or its discharge had any direct injurious influence on the bacteria, apart from the accompanying formation of chemical germicidal substances, and from whatever effects may be exercised by the heat rays.

Streptococci Pathogenic for Man.§—F. W. Andrewes and T. J. Horder have made a detailed study of Streptococci, more especially of those pathogenic for man. The authors have grouped these organisms into five main types, *Streptococcus pyogenes*, *Streptococcus salivarius*, *Streptococcus angiosus*, *Streptococcus fæcalis*, and *Pneumococcus*, according to their reactions with Gordon's nine tests, viz., reactions to milk, neutral-red, saccharose, lactose, raffinose, inulin, salicin, coniferin, mannite ; their growth on gelatin ; their morphology (longus or brevis) ; and their pathogenicity.

Referring to the bearing of their observations on the treatment of streptococcal infections, the authors point out that the polyvalent sera

* Centralbl. Bakt., 1te Abt. Orig., xlii. (1906) p. 5.
† Tom. cit., pp. 181–283.
‡ Proc. Roy. Soc., Series B, lxxviii. (1906) p. 60.
§ Lancet, 1906, ii. pp. 708–855.

now used are only polyvalent in the sense of having been prepared from a number of strains of Streptococci derived from different sources, but not necessarily presenting any differences in chemical reactions, and probably often really univalent.

Bacterial Test whereby Particles shed from the Skin may be Detected in the Air.*—M. H. Gordon finds that one particular *Staphylococcus*, with uniform and definite characters—*St. epidermidis albus*—may be considered as characteristic of the epidermis of the hand, cheek, scalp, and forearm, and its detection in air may be regarded as indicating the presence of particles shed from the skin. The author gives the cultural and biochemical tests by which this organism may be recognised.

The Production of Arabin by Bacteria.†—W. Ruhland finds that *B. spongiosus* produces a gum consisting of pure arabin. The sources of the gum are cane-sugar and raffinose. The gum formed by the cherry is an arabin-galactin mixture belonging to the galactose group and clearly distinguishable from bacterial gums. The bacterial origin of the gum described by Greig Smith in a Phanerogam is not evident and very improbable.

Physiological Action of the Chemical Products of B. enteriditis sporogenes.‡—S. Martin grew *B. enteriditis sporogenes* in broth, liquid serum, alkali-albumen, broth, and on solid serum, which was rapidly liquefied by the organism. After the bacilli had been filtered from the culture media, the filtrate was found on experiment to possess no toxic properties.

Specific Agglutinins Formed by B. coli communis, B. typhosus, B. paratyphosus, and B. proteus vulgaris.§—S. Martin has found that the agglutinin of *B. proteus vulgaris* has no action against *B. typhosus*, *B. coli communis*, or *B. paratyphosus*. The other micro-organisms show some overlapping in their agglutinating reactions in low dilutions; the agglutinin of *B. typhosus* reacts slightly with *B. coli communis* and *B. paratyphosus*; the agglutinin of *B. coli communis* reacts very slightly with *B. typhosus*, but not at all with *B. paratyphosus*; the agglutinin of *B. paratyphosus* reacts slightly with *B. typhosus*, and more markedly, though irregularly, with *B. coli communis*; in high dilutions—1 in 5000 and 1 in 1000—this overlapping is not observed.

Contagious Epithelioma of Birds.‖—Et. Burnet contributes a study of this disease which has the nature of a contagious affection resembling molluscum contagiosum, and producing local epidermic proliferations which have an epitheliomatous appearance, and the virus of which is able to pass through a Berkefeld filter. The disease affects farmyard poultry, appearing on the non-feathered parts of the head as small tumours, which after three or four weeks dry up and disappear without leaving a scar; when more extensive and affecting the feathered parts, the bird

* Rep. Local Gov. Board Med. Officer, Supp., 1904-5, p. 387.
† Ber. Deutsch. Bot. Gesell., xxiv. (1906) p. 395.
‡ Rep. Local Gov. Board Med. Officer, Supp., 1904-5, p. 377.
§ Tom. cit., p. 381. ‖ Ann. Inst. Pasteur, xx. (1906) p. 742.

often succumbs to some secondary infection. From observations on the pigeon, the author finds that the disease can only be produced by ingestion, and that although contact is a possible means of infection, it is probably not in this way that natural infection occurs. The virus is especially resistant to drying, but in solution it is readily destroyed. The immunity produced artificially by inoculation of the virus was irregular in its duration; only the living virus can confer immunity. Sections of the tumours prepared and stained according to various methods, all showed the same appearance of the cell-inclusions, which the author considers are of microbial nature, and not parasitic or products of cell-secretion or degeneration formed by the action of some unknown virus; but the bacterial nature of these inclusions must remain doubtful until cultivations can be obtained.

Bacterial Disease of Oleander.*—C. O. Smith finds that a disease affecting the stem and leaves of Oleander, causing the formation of hard woody knots, is due to a bacterium, the cultural and morphological characters of which enable it to be identified with *Bacillus Oleæ*, an organism producing a similar disease of the olive.†

* Bot. Gazette, xlii. (1906) pp. 301–10 (4 figs.).
† See this Journal, 1887, p. 286; 1890, p. 498.

MICROSCOPY.

A. Instruments, Accessories, &c.*

(1) Stands.

Old Portable Microscope by Dollond.—Major F. R. W. Sampson has kindly presented to the Society this instrument (fig. 76). The Society has not hitherto possessed one of this form, and it is therefore a very desirable acquisition, more especially as it bears the maker's name.

It seems to be an adaptation of Cuff's New Constructed Double Microscope, the body, stage, and some other details and the accessories, being similar to those of Cuff's instrument, but the pillar, instead of being fixed, is hinged to a bracket secured to the inside of the bottom of the case. The Microscope always remains in the case, which serves as a base for it. When packed the instrument lies horizontally in its box, but it can be set at any position from the horizontal to the vertical. One end of the box is hinged so as to let down and allow the mirror to project beyond when the body is elevated. To economise space in packing, the body is removed from the socket of the arm, and the stage is racked down low enough to allow of the lower part of the body being passed through the stage. The latter is then racked up until the eye-piece enters the socket of the arm from below: the body is thus securely held in place.

The pillar is square, and, as already mentioned, hinged at its lower end. The stage is attached to a sliding bracket, and is focused by rack-and-pinion. There are two springs under the stage for holding a small tube for observing objects in water. The tube is held in a diagonal position to prevent the water running out, and it also permits any air to escape and not remain to obstruct the vision as it would do if the tube were corked and used in a horizontal position. The mirror is concave, and can be moved up and down on the pillar. The body slides into a socket at the end of a short arm that is secured to the top of the pillar. The part of the body standing above the arm forms the eye-piece, the eye-lens of which is compound, consisting of two lenses, the upper one being plano-convex and the other bi-convex. The field-lens is also bi-convex. There is a micrometer scale ruled in squares, forty to the inch, screwed into the eye-piece just below the diaphragm.

Originally there were six powers—simple lenses—but No. 1, the highest power, is missing. The remaining apparatus consists of the usual spring-holder for "sliders," a cone for cutting off extraneous light from the mirror, a lieberkuhn and fitting that slides on the lower part of the body, bull's-eye and arm, stage forceps, etc. There are also two

* This subdivision contains (1) Stands; (2) Eye-pieces and Objectives; (3) Illuminating and other Apparatus; (4) Photomicrography; (5) Microscopical Optics and Manipulation; (6) Miscellaneous.

lenses of low magnification which may have belonged to a sub-stage condenser, but there is now no fitting for them.

This Microscope resembles one that had belonged to Sir David Brewster, and was exhibited at the Meeting of the Society on November 17, 1897, by Mr. C. Lees Curties. An illustrated description by Mr. Nelson appeared in the Journal for February, 1898. From the particulars

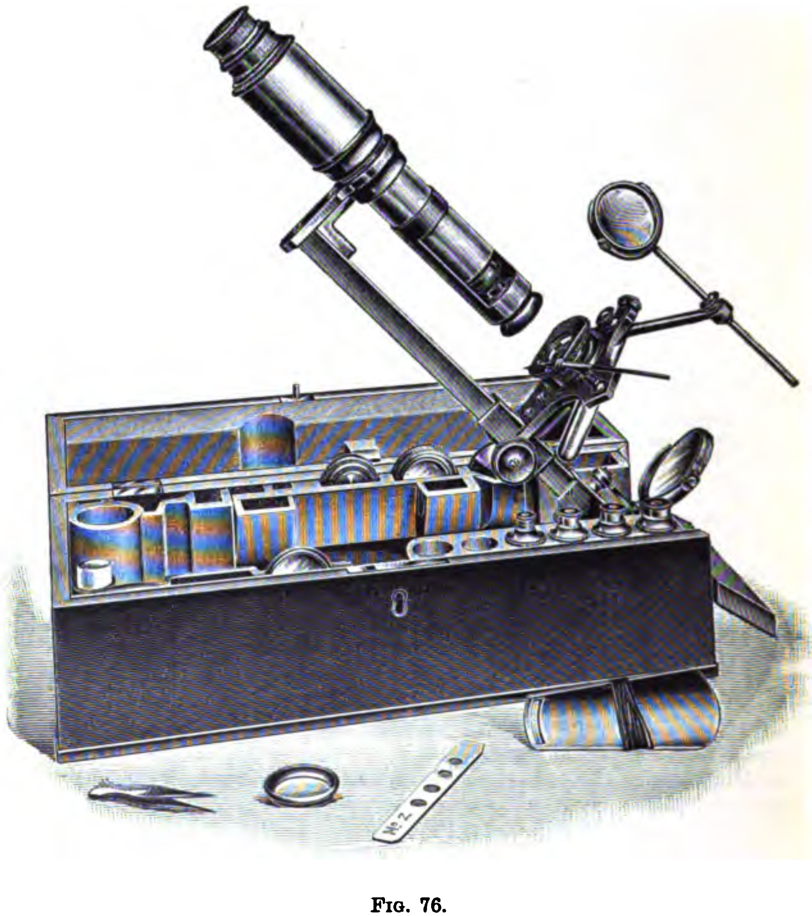


Fig. 76.

there given Sir David Brewster's instrument appears to have been larger. Its general appearance was very similar to the one now exhibited, but the stage is rectangular and has clips upon it for holding slides in position.

The case measures outside $11\frac{1}{2}$ in. by $5\frac{1}{4}$ in. by $5\frac{1}{8}$ in. deep. The total length of the body over all, from eye-cap to nose-piece, is $6\frac{3}{4}$ in.,

and from nose-piece to field-lens 4 in. The concave mirror is $1\frac{5}{8}$ in. diameter and $3\frac{1}{2}$ in. focus; there is no plane mirror. The pillar is $9\frac{1}{4}$ in. in length, from top to centre of rule-joint, and is $\frac{1}{2}$ in. square in section. The limb, or arm, is fixed; the centre projecting $1\frac{9}{16}$ beyond the pillar.

Granger's Pocket Microscope.—The Society is indebted to a Member of the Quekett Microscopical Club, who desires to remain anonymous, for this interesting little pocket Microscope (fig. 77). The donor writes that it was given to the person from whom he obtained it some thirty years ago, or more, by one of the Grangers, who were a family of lawyers. On the underside is engraved the following:—"B. Granger, Tettenhall, 1790."

This little object seems to have been a forerunner of the modern pocket magnifier. It is a sort of *multum in parvo*, for, besides an arrangement for viewing an object impaled on the point of a needle, it contains two other magnifiers, one of which is packed away within the mount of the other. The inner magnifier has an arrangement for

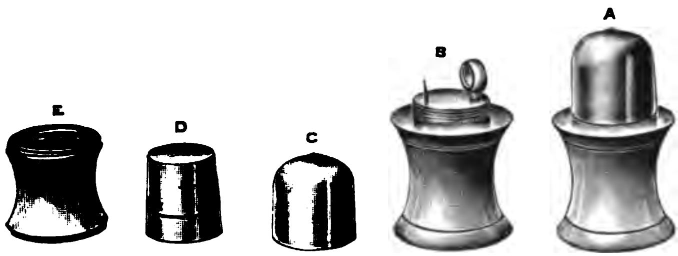


FIG. 77.

containing a minute living or other object between two glasses, one of which is concave. The lenses are all of very low power.

In this connection it may be mentioned that among the apparatus belonging to the Pritchard Microscope exhibited at the June Meeting by Mr. Holder, was an object that no one could then understand. It is evidently part of a similar box of magnifiers. The lens and needle for viewing opaque objects, and the bottom cover, are missing, and the inner magnifier is different, for, instead of the arrangement for containing a live or other object, it is fitted with a second lens, thus increasing its magnifying power.

These two specimens have been shown to Mr. Nelson, who says he has seen several similar to them, but they were made of ivory.

In the figure, A represents the brass box closed. B represents the dome C removed, and shows the arrangement for viewing an object fixed on the point of the needle. E is a magnifier formed of the central part or body of the box, the top and bottom covers being removed. It has a lens of low power mounted at the upper end. The magnifier D, which has a lens at its upper end and a live-box at its lower end, goes inside E when the box is closed.

The following are some of the dimensions of this toy :—Total height of A $1\frac{7}{8}$ in. ; diameter of base $1\frac{1}{16}$ in., diameter at centre $\frac{25}{32}$ in. ; height of dome C $\frac{13}{16}$ in. ; height of E between screwed parts $\frac{3}{4}$ in. ; height of D $\frac{11}{16}$ in. ; diameter at top $\frac{5}{8}$ in., at bottom $\frac{23}{32}$ in.

Watson's Junior Metallurgical Microscope.*— This instrument (fig. 78) is on the lines of an ordinary Student's Microscope, but the stage is a solid one designed especially for holding metal specimens, and can be raised and lowered in the optic axis, and permits of a separation between the nose-piece of the Microscope and the surface of the stage of 5 in.

The interest which is being shown in the study of Metallurgy has caused students to inquire for an instrument of simple form and less costly design than the large models which have hitherto been available.

Zeiss' Measuring Microscopes.†—1. *Microscopes for Metal Testing.* Models A, B, C of these instruments are intended for the measurement of short lengths of metals (to 20 mm.), with an accuracy of 0·01 mm. Their upper structure is essentially alike, and consists mainly of an ordinary Microscope with rack-and-pinion, the Microscope being movable on a horizontal slide by means of a screw of exactly 1 mm. thread. The spindle is rotated about its long axis by a micrometer drum whose circumference is graduated to a hundred parts. Each part corresponds, therefore, to a longitudinal movement of the Microscope equal to 0·01 mm. The magnification of the Microscope can be adapted to the object by alteration of objective and ocular. Models A and B have been constructed to the design and requirements of Dr. Schwinning.

Model A (plate XX. fig. 1). The object is placed on a simple ebonite stage-plate. The horseshoe foot rests on its base with four points only, two of the points being the rounded ends of the screws S_1 and S_2. If the piece of work, on which the measurement is to be made, be large enough and approximately plane, the Microscope can itself be placed thereon and sharply adjusted with rack-and-pinion on to the object at a distance corresponding to that of the stage-plate T. The whole of the upper structure of the Microscope is fastened to the lower part merely by means of a stout horizontal plug fitting into a strong cut collar H clamped by a screw K. It is thus possible to remove the upper part and adapt it to a laboratory stand for more convenient examination of any large object (plate XX. fig. 2). A magnification of 15–20 diameters is found to be sufficient.

Model B. This is especially intended for measurement in two mutually perpendicular directions. This convenience might be of important application in certain cases (e.g. in testing surfaces not perfectly plane), and is attained by equipping the lower part with a rotatory object-stage bearing on its circumference two grooves at 90° apart into which a spring engages. After measurements in one direction, the stage is rotated through 90°, and then a second series of measurements can be made. The upper part of the Microscope remains the same as in

* Watson and Sons' Special Catalogue, 1906.

† Carl Zeiss' Special Catalogue, Jena, October 1906.

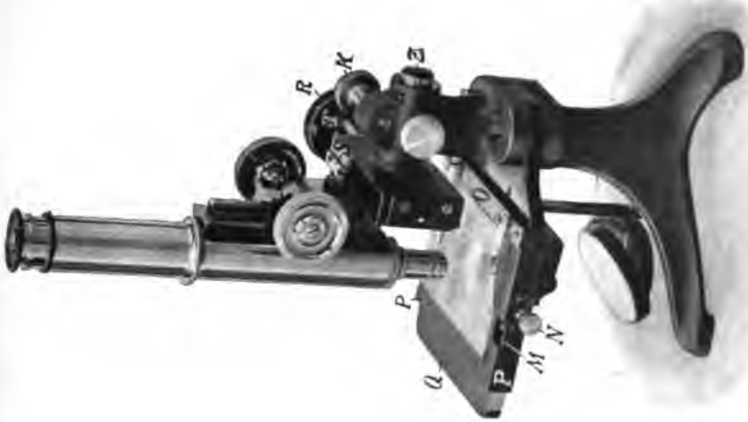


Fig. 3.

Fig. 2.

5.
des
p. 167.

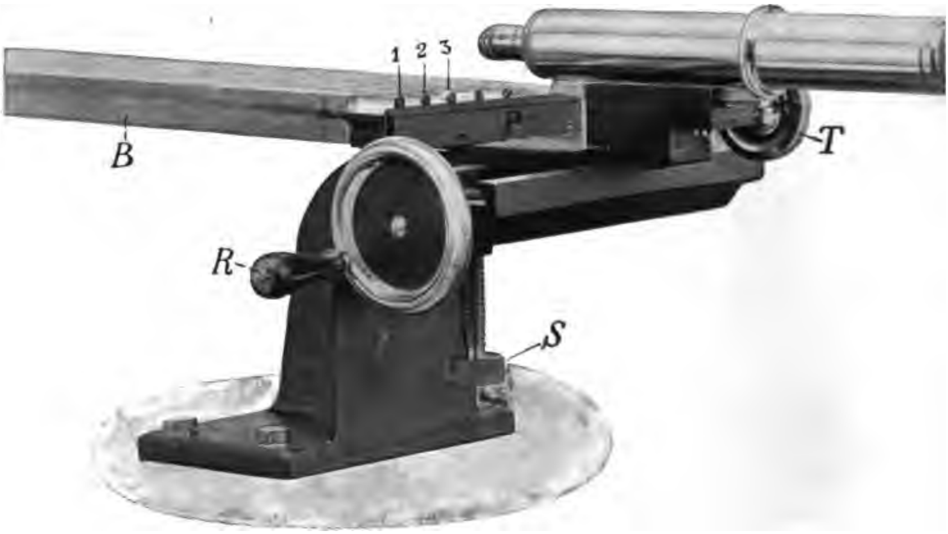


Fig. 4.

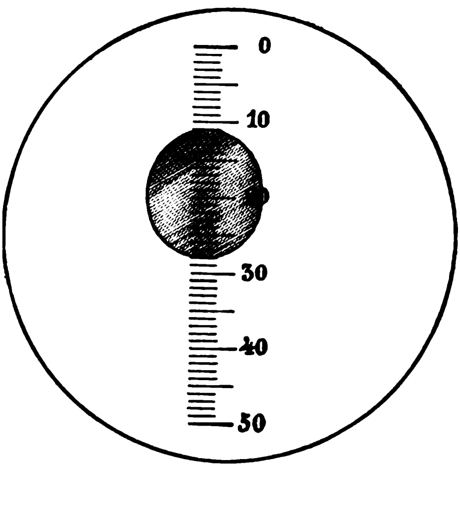


Fig. 5.

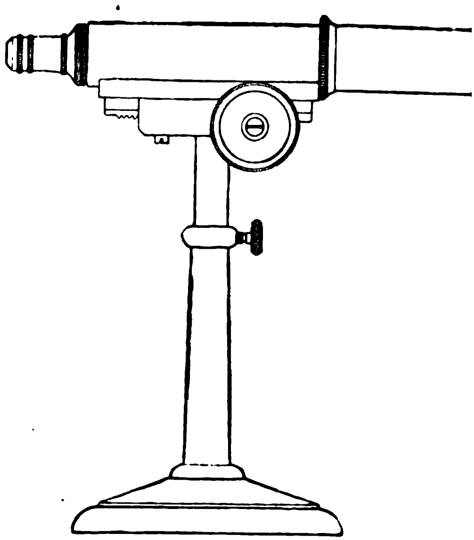


Fig. 6.

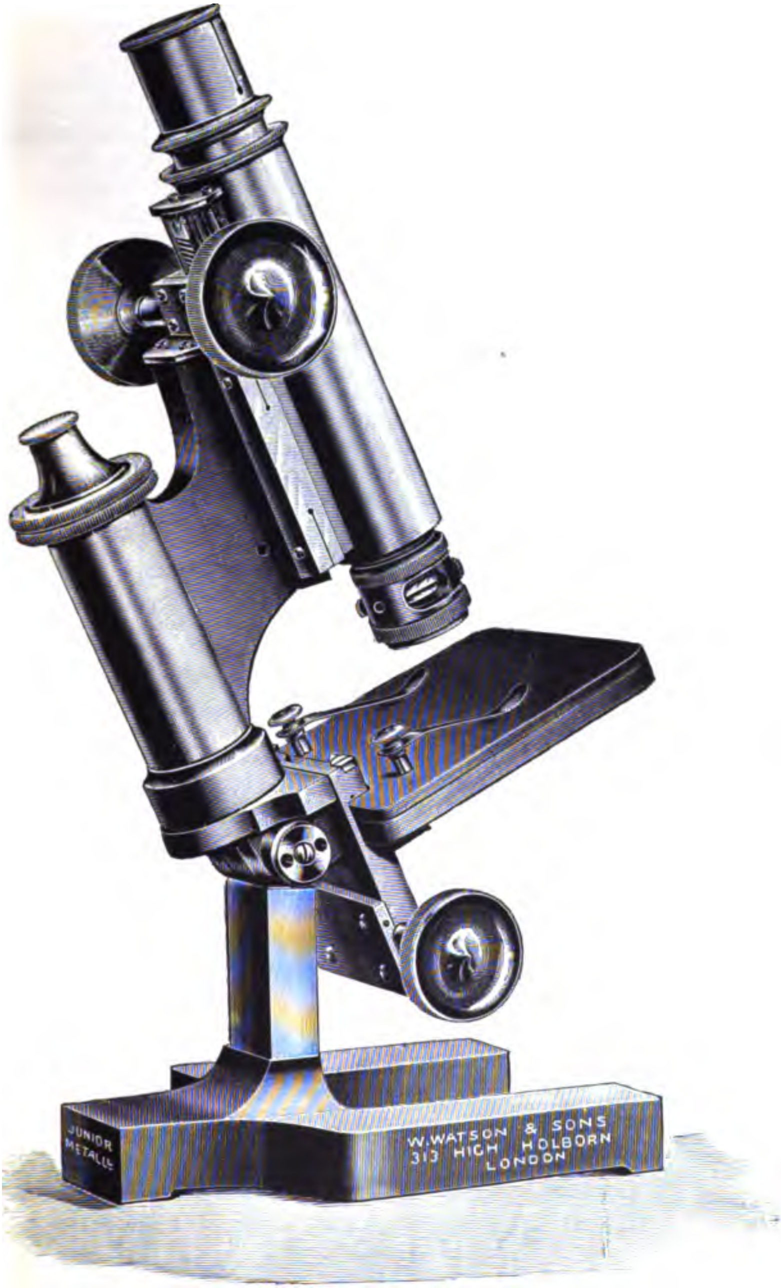


FIG. 78.

model A. The instrument can be applied to a large object, either directly or by help of a laboratory stand, exactly as A.

2. *Measuring Microscope for Negatives.*—This (plate XX. fig. 3) is, in the first instance, intended for the measurement of photographs of physical observations, e.g. spectra. It has the same ranges of movement and accuracy as models A and B. It may also be used for exploring plates of 6 by 9 cm., and for many other purposes. It differs from the previous instruments in possessing a stable understage with illuminating mirror, and a strong stage with central aperture of about 3 cm. diameter. But it resembles them in being provided with the collar H, and similar overstage. It has the same facilities for adaptation to a laboratory stand. The square strong stage is so worked on its right and left side planes that these can serve as guides to a metal frame sliding on the stage top. On this frame the plate to be measured is secured with two springs; the plate is then pushed on to the millimetre divisions serving as a bed. The frame can thus be pushed perpendicularly to the direction of the slide-guides and clamped by the screw N. Comparison of equal intervals of spectra is attained by this movement of the frame. Besides these millimetre graduations, there is also a second series, perpendicular to the first and readable through a window pierced in the frame. The two series serve as co-ordinates for localising any spot on the plate.

3. *Capillary Measuring Microscopes.*—These are made in two models (D, E), and have been suggested by the firm of F. A. Kühnlenz. They are intended for direct reading of the internal diameters of capillary tubes of any length, and therefore facilitate the rapid sorting of large quantities of such tubes according to their bore. The Microscope is adjustable with rack-and-pinion T, and has a magnification of about 100 diameters. The ocular contains a scale (plate XXI. fig. 5) reading the object to the hundredth part of a millimetre. Plate XXI. fig. 4 shows model D, about half full size. The capillary tubes, which may be 1½ metres long, are placed on the board B, and the operator commences to read the lowest layer. As the Microscope is more easily moved than the heavy tubes, the instrument is placed on a slide which traverses the row by means of the hand-wheel R. In this way every tube of the lowermost layer can be successively brought into the field of view of the Microscope. Plate XXI. fig. 5 shows the appearance presented in the ocular. It is found convenient to take first the higher reading (28 in this case) and then the lower, as the figures are then conveniently placed for subtraction. It would, of course, be possible to place one edge of the circumference on the zero and take the diameter by direct reading; but experience shows this to be a slower way. By means of the screw S, the board is lowered till the next layer of tubes comes into view. These are tested in similar fashion. The instrument may also be used for calibrating thermometer tubes. In that case the spindle carries a micrometer screw, and the hand-wheel has a micrometer drum divided into 100 parts.

Model E, seen in plate XXI. fig. 6, consists of a Microscope with rack-and-pinion. It has the same optical equipment as model D, but is mounted on a pillar of adjustable height. It may be used for the tubes,

as above, but by application of suitable objectives and oculars, may also be used as a reading Microscope for general laboratory use.

FABRE, CH.—**Les nouveaux microscopes.**
[Gives some account of recent progress in the manufacture of instruments.]
Mémoirs de l'Acad. des Sci. de Toulouse, v. (1905) pp. 289–96.

PLATE, L.—**Demonstration eines Schau-Mikroskopes für öffentliche Museen.**
Compt. Rend. des Séances du Congrès internat. de Zool. Berne, 1904.
Basle, 1905, pp. 529–30 (1 fig.).

(3) Illuminating and other Apparatus.

Watson's Ball-bearing Sliding Bar.—The illustration (fig. 79) shows the method by which this sliding bar is adapted to the stages in Watson and Sons' Microscopes. A grooved edge is provided in the stage, and

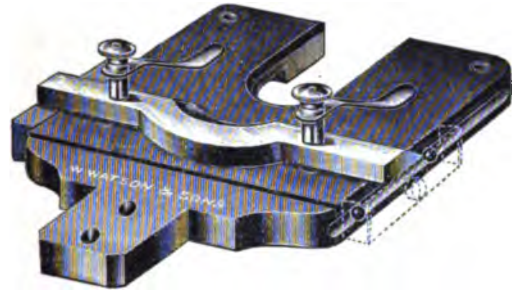


FIG. 79.

two steel balls fit into the grooves and are maintained in position by a light spring pressing on the back. A very soft movement is obtained by this means.

Simple Photometer.*—Stolze suggests the use of two right-angled prisms, *cde* and *cfg*, fig. 80, fastened to a thin sheet of opal glass.

Assuming the light sources to be at *a* and *b*, the prisms have only to be shifted to the right or left till the illumination is even, and the

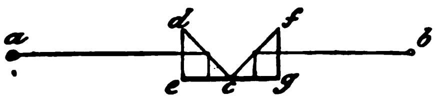


FIG. 80.

distances ac and bc measured; then the intensities of the lights will be as $(ac)^2 : (bc)^2$. This arrangement can obviously also be used to compare the actinic power of the two lights, and would be useful in measuring the power of the various illuminants for the Microscope.

Tswett's Luminoscope.†—M. Tswett, in discussing the interest universally excited by ultramicroscopes, draws attention to his lumino-

* Brit. Journ. Photography. See also English Mechanic, lxxxiv. (1906) p. 299 (1 fig.).

† Tswett, Zur Ultramikroskopie, Ber. Deutsch. Bot. Gesell., xxiv. (1906) p. 234. See also Zeitschr. wiss. Mikrosk., xxiii. (1906) p. 199.

scope, invented and described as far back as 1901.* In this instrument a strong beam of light is axially directed through a test-tube filled with the fluid to be examined, the tube being in a dark box. The light-trajectory is observed perpendicularly through a lateral ocular-tube. If the fluid is capable of fluorescence, or in a stricter sense not optically empty, the appearance presented is that of a luminous (fluorescent or opalescent) beam. A polarising prism applied in the ocular opening distinguishes between fluorescence or opalescence, for the latter, being polarised, is extinguished by rotation of the prism. Tswett's luminoscope does not render possible the direct observation of ultramicroscopic particles, but it establishes in a general way the presence of such particles. In physiological-chemical investigations (e.g., of chlorophyll pigments), where the observer has to be specially careful with regard to purity or accuracy of the solutions, or where he has to deal with mere traces of fluorescent materials, he will find the luminoscope an indispensable instrument.

(4) Photomicrography.

Principles on which Direct Photography of Colours Depends; Direct Colour-Photography Depending on Prismatic Dispersion.† M. G. Lippmann points out that two conditions are necessary in order that a photographic proof may reproduce the colours of the model.

1. The sensitive plate should clearly distinguish the differences existing between the various radiations combined in an incident ray: in other words, the system employed should analyse the incident ray.

2. In order that this incident ray, after impact, should be reconstituted with its colour, the system employed should be reversible, so as to effect the synthesis of elementary colours. Now, prismatic dispersion as used in a spectrocope is such a system. A photographic spectroscope is composed essentially of a slit *f*, a prism, a lens, and a sensitive plate. It evidently effects the analysis of the light incident on the slit; thus it remains to show that the apparatus is by itself reversible and that it does reconstitute after impact, the coloured light which has impinged on the slit. Let us suppose that the sensitive plate has been developed, a positive obtained, and the plate replaced by the positive. If the slit has been illuminated by (e.g.) red rays, these rays will have produced in the spectrum an image *r* of the slit. This image is transparent on the positive proof and constitutes a kind of slit which, when the plate has been replaced, is the conjugate image of *f*. Inversely *f* is the conjugate image of *r*. It follows that, if *f* be illuminated with white light, the transparent region *r* will receive only the rays which have formed it, and will only transmit those. If the light is inverted and *r* is illuminated by white light, only those rays will be transmitted which have left their trace on *r*. This reasoning applies to light of any refrangibility whatever. When the positive proof is replaced by its negative the slit is illuminated by a light exactly complementary to that radiation which had acted on it, and thus

* Vorrichtung zur Beobachtung von Fluoreszenz- und Opaleszenzerscheinungen, Zeit. Physik. Chemie, xxxvi. p. 450; Constitution physicochimique du Grain de Chlorophylle, Trav. de la Soc. des Naturalistes de Kazan, xxxv. p. 58.

† Comptes Rendus, cxliii. (1906) pp. 270-2.

r in the spectrum is opaque. Thus, this particular radiation will not be able to reach the slit, for the only radiations of this kind which would have been able to fall upon the slit would have had to pass through r. In order to apply these principles to the reproduction of colours the author has installed the following apparatus. The single slit of a spectroscope is replaced by a series of slits very close together, viz. the fine transparent lines of a web, five threads to the millimetre, as used in industrial photography. This web is fixed in the opening of a photographic enlarger, i.e. of a box fitted at the mouth with a slit carrying a sensitive plate, a convergent lens being fixed inside. A small-angled prism is arranged before this lens with its edge parallel to the lines of the web. The image is projected on the web; the sensitive plate is then developed and replaced. When the apparatus is illuminated with white light the image is seen with its colours. Each line of the web acts as the slit of a spectroscope. At the distance of distinct vision the lines of the web are no longer seen and the image appears continuous. The experiment was at first made with the spectrum of electric light, which was reproduced complete with its colours, a positive being used. With a negative the colours were replaced by their complementaries. A coloured window, red and green, projected on this web was similarly successfully reproduced. It is necessary that the prism should have an angle so small that each spectrum should have a length less than an interline, otherwise the spectra will overlap. It is also necessary that the photometric plate should be re-inserted in exactly the same position. Very sensitive orthochromatic plates may be used. It must be admitted that the necessity of having to replace the proof in the same apparatus which has produced it is not very convenient. When seen in the hand the proof has the ordinary black-and-white appearance. Seen with a lens it appears lined, and each line is divided into small zones which are the parts of an elementary spectrum. The author suggests the following as a possible improvement of the process. Insert a sensitive plate in an ordinary dark camera, without a prism, but with a web of, say, five threads to the millimetre. Superpose on the web a network of 500 threads to the millimetre. Every luminous point projected on the plate is received as a spectrum and so photographed.

On applying the web with its network upon the developed proof the colours of the original ought to be seen, the only condition being that the eye should occupy the position of the objective. The system is, in fact, reversible in virtue of the reasoning above given.

LIPPMANN, M. G.—**Remarques générales sur la photographie interférentielle des couleurs.** *Comptes Rendus*, cxliii. (1906) pp. 273-4.

(5) Microscopical Optics and Manipulation.

BRASS, A.—**Ueber die Doppelbrechung.** *Centralbl. Zeit. f. Opt. u. Mech.*, xxvii. (1906) pp. 192-4 (1 pl.).

HARTL, H.—**Ein Modell zur Erläuterung der Zerlegung eines linear polarisierten Lichtstrahles bei der Doppelbrechung.** *Zeitschr. f. Unterricht*, xix. (1906) p. 175.

KOERBER, F.—**Ein Freihandversuch zur Ermittlung des Brechungsexponeten des Glases.** *Tom. cit.*, p. 167.

(6) Miscellaneous.

Principles of Microscopy: being a Handbook to the Microscope.* This book fills a gap in the literature of the subject, inasmuch as it is written for the information and guidance of microscopists, to whom the theory of the instrument with which they work is a matter of practical, as distinguished from speculative interest. Although the undulatory theory and the mathematical analysis of light pervade the work, they are never suffered to become either the subject-matter of discussion or its medium. The author absolutely eschews the "inarticulate" method of expression by means of mathematical signs, with the result that the book is a literary work from end to end. Notwithstanding the abstruse nature of many of the problems attacked, it is readable by everybody, mathematician or not, to whom the Microscope is practically familiar.

The work is divided into two parts. The first part deals with the "object picture," a term used to denote the object under that aspect which furnishes a picture to the eye. Object pictures are classified under four heads—as "outline pictures, colour pictures, outline and colour pictures, and pictures in relief." The advantages and disadvantages which attach to these various kinds of images—considered as means of revealing the form and structure of objects—and their liability to originate false impressions, form the subject matter of the first chapter. The next three chapters of the first part are devoted to the examination of the practical consequence deducible from the principles developed in the first chapter, and in these the theory and practice of illumination, mounting, and staining are successively discussed, while the fifth chapter sums up the whole result, and points the moral of what has preceded. These five chapters together thus form a treatise upon the preparation and exhibition of transparent objects in the Microscope, with special reference to such objects as occur in the course of medical practice and research.

The second part is much the larger part of the book, and is devoted to the image formed by the Microscope. This part of the work, therefore, covers more familiar ground than the first, since all the text-books which treat of the theory of the Microscope deal with this subject. The mode of treatment is, however, in this part equally original, and an impression which the author is very successful in leaving on the mind of his reader is that there is nothing occult about the theory of the Microscopic image. The optical laws involved, even where high magnification is concerned, are all illustrated by experiments which can be made with low-power lenses and large scale objects. The notion that microscopic vision is something *sui generis* finds here no quarter.

Ten chapters are devoted to this division of the work. The first of these—the sixth chapter of the book—is devoted to the discussion of images formed by simple apertures, from which the general laws of image-formation are very ingeniously deduced, and the main ideas, such as magnification, illumination, definition, and resolution—with which the reader is concerned to become familiar—are easily intro-

* By Sir A. E. Wright, M.D. F.R.S. London: Archibald Constable and Co., Ltd., 1906, xxii. and 250 pp., 18 pls. and 97 figs. in text.

duced and clearly illustrated. Following this is a chapter upon image-formation by means of lenses, or, as our author says with greater exactitude, by means of "lens-armed" apertures. The essential importance of the aperture in the formation of an image is never allowed to escape the reader's attention, and leads in the end to a notable elucidation of some of what are commonly supposed to be the more abstruse problems in the theory of the Microscope. But it is true—and a truth of which the reader of this book grows very conscious as he proceeds—that abstruseness is a matter depending almost wholly upon the point of view and mode of approach. Many things which seem remote and abstract when treated merely as aberrations become very concrete and very intelligible when presented as fundamental facts. The question whether a particular phenomenon shall take rank as the rule or the exception is usually a question simply of the point of view. Sir A. E. Wright chooses to build up his theory of the Microscope about an aperture as its essential element. The various lenses and combinations of lenses which enter into the composition of the instrument are merely so many appliances for supplying the deficiencies of the "vacant aperture." They improve the definition of the image which the simple aperture yields, and increase the resolving power of the beam which it transmits, but the theory of the instrument and of its image is nowhere involved with the theory of lenses; and the reader—working out by easy steps the properties of the simplest imaginable images—finds that he is successfully grappling with some of the tougher problems of image formation almost before he is aware that he is fairly launched upon the subject. Thus the seventh chapter, which for the first time introduces the lens and its function to the reader's notice, puts him in possession, and almost without effort, of matters so "abstruse" as Huyghen's law of wave-front propagation, and La Grange's numerical relation between magnifying power and the diameter of the Ramsden disk.

Succeeding chapters treat of the defects which occur in the image through aberration caused by the lens, and diffraction produced by the aperture—in connection with which latter subject a singularly complete series of experiments serves to illustrate the effect which the form and dimensions of the antipoint have upon the appearance of the image. In this connection the "Abbe theory" comes up for discussion, and an exposition of the optical system of the eye, and of the psychological factors involved in the use of the Microscope, completes what may be called the abstract theory of image-formation with the aid of lenses. What is really a subdivision of this second part commences with the eleventh chapter, in which the simple Microscope is discussed. Following upon this by a regular development comes a chapter dealing with image-formation in the compound Microscope, and another in which the anatomy of the compound instrument is discussed in detail. We thus come to the fourteenth chapter, which deals with the much-neglected subject of dark-field illumination, and following this is a chapter in which the corners of the subject are swept up by the discussion of various adjustments necessary for securing a critical image. The sixteenth (and last) chapter is

devoted to the question of the limit of resolving power, and the problems especially associated with high magnification.

Very remarkable is the way in which the whole subject is illustrated by experiments, and experiments conducted by means, for the most part, of apparatus of extraordinary simplicity. The writer's resource in this direction may be illustrated by his discussion of subjective colours, which is based, in fact, upon a coloured plate facing page 20. Excellently coloured diagrams accompany the text and make the meaning clear to the eye, and by an ingenious use of the tissue paper employed to protect the plate from contact with the printed page opposite to it, the effect of letting a top light in to the stage of the Microscope is most strikingly and successfully imitated. The work is spoken of in the preface as a task which has occupied the author for many yea s, and it may be admitted that the unusual amount of original work of which the reader finds traces on almost every page, seems to warrant this statement being taken *au pied de la lettre.*

The book is admirably printed and illustrated, so that its publishers may fairly claim to have placed the work before their readers in the best possible form.

Note on Sir A. E. Wright's Resolving Limit.*—Mr. Nelson writes: "The wave-length selected by Sir A. E. Wright in his examples for ultimate resolution is 0·6 μ; this lies on the red side of the sodium or D line, whereas the one commonly used is that of maximum visual intensity, which is situated on the blue side of the D line, about one-third of the distance between D and E.

"It is therefore not possible to compare his results with those in the table at the end of this Journal, or with those in my table on p. 529 of

Numerical Aperture. ($n \sin u = a$)	Sir A. E. Wright's Resolving Limits with the usual values of λ. $c = 1 \cdot 2$ $\kappa = \frac{1}{\lambda}$ Limit $= \frac{2\,\mathrm{N.A.}\,\kappa}{c}$						Illuminating Power $\left(\frac{\mathrm{N.A.}}{c}\right)^2$	Penetrating Power $\frac{c}{\mathrm{N.A.}}$
	White Light. $\lambda = 0 \cdot 5607\ \mu$. Number of lines		Blue Light. $\lambda = 0 \cdot 4861\ \mu$. Number of lines		Photography. $\lambda = 0 \cdot 4000\ \mu$. Number of lines			
	in $\frac{1}{100}$ in.	in $\frac{1}{10}$ mm.	in $\frac{1}{100}$ in.	in. $\frac{1}{10}$ mm.	in $\frac{1}{100}$ in.	in $\frac{1}{10}$ mm.		
·2	151	59·4	174	68·6	212	83·3	·028	6·0
·3	226	89·2	261	102·8	317	125·0	·063	4·0
·5	377	148·6	435	171·4	529	208·3	·17	2·4
·7	528	208·1	609	240·0	741	291·7	·34	1·7
1·1	830	327·0	958	377·1	1164	458·3	·84	1·1
1·3	981	386·4	1132	445·7	1375	541·7	1·2	0·92

this Journal (1906), before bringing them to terms of the same denomination. It will be noticed that the value of c adopted in the 'Principles of Microscopy' is 1·2.

"The values for objectives with N.A.'s other than those in this table may be found by inspection, by halving or doubling the values there

* Principles of Microscopy, 1906, by Sir A. E. Wright, p. 231.

given. Example: Required, the number of lines in the $\frac{1}{100}$ of an inch that can be resolved by an objective of 0·65 N.A., with white light.

"Take the half of 0·3 and the half of the corresponding number of lines, and we find that an objective of 0·15 will resolve 113 lines; this added to those opposite to 0·5 gives the answer—490 lines in the $\frac{1}{100}$ of an inch that can be resolved by an objective of 0·65 N.A. with white light.

"This method of inspection is much quicker than that of multiplying a constant out by the N.A., but this rule does not apply to the columns "Illuminating and Penetrating Powers": those figures must be worked out independently.

"If the values given in the table at the end of the Journal be multiplied by 0·833 they will be reduced to Sir A. E. Wright's limit, and if they are multiplied by 0·769 they will be reduced to those given in my table on p. 529 (1906). To reduce my table to Sir A. E. Wright's, multiply by 1·083.

Application of the Method of Rotary Disks to Microscopical Technique.*—H. Lebrun has given much attention to the best means for attaining rapid and systematic examination of microscopic objects. With this purpose in view he has constructed several contrivances.

1. *The Microstereoscope.*—This is intended for the examination by museum visitors of small creatures visible, but whose characters are only revealed by a microscopic view. The author arranges a kind of endless chain, on the principle of what are called American stereoscopes, working obliquely upwards. Each link of the chain carries a slide provided with an object, and this object at a certain part of the chain motion falls into a position suitable for observation by a fixed Microscope. Fifty slides are mounted in this way, and can be varied by the museum curator as he thinks fit. The whole arrangement is inclosed in a wooden case provided with a suitable window for admission of light. The body of the Microscope and certain adjustment screws are the only parts visible outside the case. The author uses a binocular, and the magnification employed does not exceed 70 diameters.

2. *A Microscope Table.*—This arrangement is suitable for the use of objects requiring high powers. A specially designed table carries the Microscope, and a disk bearing the slides rotates in a constant plane so as to bring the objects successively under the instrument. The table is mounted on four feet, of which the two rear ones are higher than the front, so as to slope the Microscope at an angle of 45° to the horizon. The four feet carry a metallic rectangular frame containing a kind of mechanical stage, to which the Microscope limb is attached without the usual foot. Verniers are attached to the two plates of this stage for the precise measurement of abscissæ and ordinates. The rotary disks are secured to a small vertical pin in such a way as to insure constancy of plane, smoothness of rotation, and facility of replacement. The disks may be of metal, wood, or cardboard, and may be solid or perforated. When a disk has been once equipped with a series of slides it may be removed and kept intact for future demonstrations.

3. *Microtome.*—In ordinary serial section-cutting it is not unusual to

* Zeitschr. wiss. Mikrosk., xxiii. (1906) pp. 145–73 (36 figs.); also published as an extract.

obtain ribbons more or less incurved owing to want of perfect rectiliniarity in the preparation of the paraffin block. The author has sought to regularise the inrolling so as to form ribbons of sections whose curvature should vary with the circumference of the disk where they are to be deposited, with the dimensions of the block to be sectionised. To obtain this result it is only necessary to give to the paraffin block a shape whose two faces correspond to two rays of the disk determined by the dimensions of the object. This cutting is facilitated by the use of a specially designed articulated and adjustable knife. A Minot-Zimmermann microtome with vertical carrier is adapted so that the sections fall, as cut, on a rotating glass disk and range themselves spirally, ready, save for clearing and covering, for immediate examination.

4. *Rotatory Stage.*—The disk just referred to, is of a size suitable for the Microscope stage, and is transferred to it. The disk is perforated at its centre, and this perforation enables it to be placed on a sort of vertical pin in the centre of the stage and secured by a nut. A rack-work movement is connected with the pin so that the disk may be rotated or moved as a whole in two mutually perpendicular directions.

Mounting Stereoscopic Views.*—Stereoscopic slides cannot give a true stereoscopic effect unless they are observed under the same conditions of convergence as those which prevailed when the exposures were made, and the true effect cannot be secured unless the views are mounted with the proper degree of separation, and observed from the proper distance. If the two negatives are on one plate, as is usual in most cases, and are produced with lenses a known distance apart, it is quite easy to ascertain the proper mounting separation for the positives.

The complete rule for a lenticular stereoscope is as follows :—Add the separation between the two lenses (centre to centre) to the distance separating the eyes of the observer, and then deduct the distance between any two corresponding points on the two negatives. The result is the proper separation of the same two points in the positive prints. If the points selected are distant points, their separation on the negatives will be equal to the lens separation, and the two distances will therefore cancel each other. It is then only necessary to mount the positives so that two corresponding distant points are separated by a distance equal to that between the eyes. If there are no distant points in the view, the complete rule must be applied, and if all the objects are very near, it is especially important that the rule should be strictly observed. If a prismatic stereoscope is to be used, the width of one prism should be added to the positive separation as found by the rule. This addition is exactly correct if the prisms are half-lenses properly centred in front of the eyes; and though these conditions are seldom fulfilled, the correction is generally true enough for all practical purposes. With very near objects and widely separated lenses the proper separation for the positives is sometimes so small that the prints have to be trimmed down to absurdly small dimensions. Further, the negative images come very near the ends of the plate. To avoid these effects the separation of the lenses must be reduced, and the adjustment is

* British Journal of Photography. See also English Mechanic, lxxxiv. (1906) p. 208.

best made by trial on the focusing screen, for if each of the two negative images is fairly well centred in its own half of the plate, a convenient mounting separation will generally be secured.

Quekett Microscopical Club.—The 433rd Ordinary Meeting of the Club was held on October 19, the President, Dr. E. J. Spitta, F.R.A.S., F.R.M.S., in the chair.

Mr. C. F. Rousselet, F.R.M.S., gave a corrected description, and exhibited a specimen from the Matoppo Hills, Rhodesia, of the rare Rotifer *Tetramastix opoliensis*.

Mr. Jas. Burton read a paper "On the Reproduction of Mosses and Ferns."

B. Technique.*

(1) Collecting Objects, including Culture Processes.

Doulton's White Porcelain Filter.†—W. Bullock and J. A. Crau have tested the filter recently introduced by Doulton and Co., of Lambeth, using as control the Chamberland F. Filtration experiments

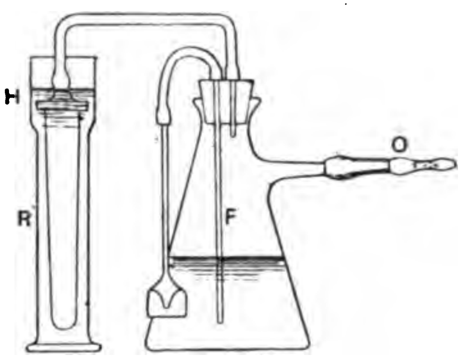


FIG. 81.

at low pressure showed practically no difference between the two filters. Tested by means of the vacuum pump, it was found to be eminently suited for obtaining sterile filtrates in the laboratory. Under high pressures (taps and mains) the results were quite as satisfactory as those obtained by other filters, but the candle was occasionally liable to break at the base, a defect remediable by making the candle a little thicker. The illustration (fig. 81) shows the apparatus fitted up for laboratory work.

Medium for Cultivating Delicate Microbes.‡—G. Bordet and O. Gengou have cultivated successfully the bacilli of whooping-cough

* This subdivision contains (1) Collecting Objects, including Culture Processes; (2) Preparing Objects; (3) Cutting, including Imbedding and Microtomes; (4) Staining and Injecting; (5) Mounting, including slides, preservative fluids, etc.; (6) Miscellaneous.

† Journ. Hygiene, vi. (1906) pp. 409–20 (4 figs.).

‡ Ann. Inst. Pasteur, xx. (1906) p. 734.

and influenza, gonococcus and meningococcus, on a medium the mode of preparation and composition of which is as follows. To 200 c.cm. of 4 p.c. glycerin-water are added 100 grm. of sliced potato; by boiling this mixture in an autoclave a glycerin-extract of potato is obtained. To 50 c.cm. of this extract are added 150 c.cm. of 0·6 p.c. salt solution and 5 grm. of agar (gélose). After melting it in the autoclave, the potato-agar is distributed into test-tubes, about 2–3 c.cm. in each, and then sterilised.

Rabbit's blood (though human is preferable) obtained aseptically is defibrinated, and to each tube, the agar being previously melted, is added an equal quantity of blood. The tubes are well shaken, and then cooled on the slant.

As this medium does not contain pepton, it does not favour the growth of putrefactive bacteria.

Fish Tubercle grown at 37° C.*—A. Aujeszky cultivated the fish tubercle bacillus on potato dipped in 3 p.c. aqueous solution of glycerin, and incubated at 28°–30° C.; after six weeks, and at successive intervals of six weeks, sub-cultures were made and incubated at gradually higher temperatures, so that the fifth generation grew well at 37° C.; the cultures were now no longer white and moist, but yellow-grey to brick-red, and resembling mammalian tubercle. The eighth generation was fatal to a guinea-pig after 63 days; control experiments with fish tubercle grown at room temperature were without effect.

Bacterioscopic Analysis of Excremental Pollution.†—E. Klein insists that *B. coli communis* is the typical microbe of sewage and excremental matter. MacConkey's medium makes no selection between typical and atypical *B. coli*, nor does it exclude other microbes capable of producing acid and fermenting glucose. The principal differential character of *B. coli communis* is its power to ferment lactose. The author inoculated, with high dilutions of sewage, human fæcal matter, fluid from shell-fish, from polluted layings, and also from clean layings, in parallel series, tubes of ordinary MacConkey medium, and MacConkey medium made with lactose instead of glucose. The results showed that whenever the lactose MacConkey tubes showed redness and gas after 24–48 hours at 37° C., subsequent sub-cultures proved the presence of typical *B. coli communis*; whereas in a number of cases, after redness and gas in ordinary MacConkey tubes, subsequent sub-cultures failed to show the typical *B. coli communis*; when the lactose MacConkey tubes remain unchanged or become bleached and without gas, it is certain that *B. coli communis* is not present, although in the glucose MacConkey tubes, redness and gas have been produced.

Taurocholate broth (5 c.cm. of 5 p.c. solution of sodium taurocholate to 400 c.cm. of broth) that shows turbidity and gas-formation after 24–48 hours incubation at 37° C., is a certain indication of the presence of typical *B. coli communis*. The author found also that this medium allows the growth of fæcal streptococci, but inhibits the growth of *Streptococcus pyogenes* and the streptococcus of saliva.

* Centralbl. Bakt., 1te Abt. Orig., xlii. (1906) p. 397.
† British Med. Journ., 1906, ii. p. 1090.

Value of Malachite-green Medium for Differentiating B. typhosus and B. coli.*—G. Kiralyfi has made a number of observaions of cultivating bacteria on media containing malachite-green, and from these he concludes that the addition of this material does undoubtedly hinder and stop the growth of many micro-organisms, such as streptococci, staphylococci, *B. anthracis*, *Vibrio choleræ*, etc., but for the purpose of differentiating *B. typhosus* and *B. coli*, it is irregular and quite unreliable.

Cultivation of Microbes in Media of Definite Chemical Composition.†—J. Galimard, L. Lacomme, and A. Morel obtain acid amides from the hydrolysis of various albumens, and these are then added either separately or mixed together, in proportion of 1 to 2 p.c. to bouillon composed of sodium chloride 0·5 grm., sulphate of magnesium 0·05 grm., glycerophosphate of calcium 0·2–0·3 grm., bicarbonate of potash to produce a slight alkalinity, glycerin 1·5 grm., and water 100 grm. The whole is sterilised at 120° C. for 45 minutes. The different media thus obtained from the various albumens are then inoculated with *B. pyocyaneus*, *B. prodigiosus*, *B. coli* R 2, and pneumobacillus of Friedlander, etc.

Cultivation of Bacillus typhosus from the Blood by means of Bile Culture Medium.‡—H. Conradi places a mixture of one part of blood from a typhoid patient and two parts of sterilised ox-bile in an incubator for 16 hours, after which varying amounts of the mixture are transferred to litmus-lactose-agar. An addition of 10 p.c. of pepton to the bile encourages the growth of *B. typhosus*, and better results are obtained by an addition of 10 p.c. of glycerin which hinders the development of saprophytes. The principle of this medium depends on the fact that whereas 0·3 c.cm. of normal guinea-pig serum in dilution of 1 in 80 will kill 20,000 typhoid bacilli within two hours, after the addition of 1–0·1 c.cm. of bile to the same normal guinea-pig serum, the bactericidal serum action is no longer observed. The author claims that this method may be readily used by general practitioners and clinicians, and he describes its practical application. It is further claimed that after 30 hours it is possible to establish with certainty a typhoid diagnosis.

(2) Preparing Objects.

Studying the Tympanal Apparatus of Orthoptera.§—J. Schwabe begins his description with the remark that he has had no trouble with the chitin, and has made perfect series of sections. He begins by removing quickly all superfluous parts, and then getting the material into paraffin as rapidly as possible. The prolonged use of alcohol must be avoided, as it obscures the histological details and also makes the chitin so brittle that it cracks like glass when cut. Each section should be picked up with a brush. The use of eau-de-Javelle, eau-de-Labarraque, or hot potash is deprecated. The difficulty of fastening sections of

* Centralbl. Bakt., 1te Abt. Orig. xlii. (1906) p. 371.
† Comptes Rendus, cxliii. (1906) p. 349.
‡ Centralbl. Bakt., 1te Abt. Orig., xxxviii. (1906) p. 55.
§ Zoologica, xx. (1906) pp. 3–5.

Orthoptera to the slide is easily overcome by sticking them down with 0·25–0·5 p.c. solution of photoxylin in equal parts of alcohol and ether; this does not interfere in any way with the further manipulation.

The fixatives mostly used were Flemming's and Hermann's fluids, but excellent results were obtained from formalin-chrom-acetic acid and formalin-alcohol-acetic acid; in the formalin mixtures the material was immersed for 6–8 hours.

The sections, which were from 3–20 μ thick, were stained with Heidenhain's iron-hæmatoxylin or with Ehrlich's alcohol-hæmatoxylin.

Studying the Histology of the Lungs of Domesticated Animals.*—J. Müller fixed the lungs with absolute alcohol, or with 4 p.c. formalin, by passing these fluids into the trachea. For alcohol 48 hours sufficed, while formalin required 4 days or longer. Cubical blocks with sides from 0·5–1·2 c.m. were cut out of the fixed tissue. The pieces fixed in formalin were dehydrated in upgraded alcohols. The material was then cleared in xylol or cedar-oil, and afterwards imbedded in paraffin, the latter process taking several days in order to get rid of all the air. Sections from 4–30 μ were made, and were stained with hæmatoxylin, hæmalum, borax-carmin, and lithium-carmin. The contrast-stains were eosin, fuchsin, or Hansen's picric-acid-fuchsin. The elastic fibres were picked out by Weigert's method. For the mucous glands, thionin, mucicarmin, muchæmatin, and methylen-blue were used.

For corrosion preparations Wickersheim's alloy (lead 32, zinc 16, bismuth 60, cadmium 12, mercury 10 parts) was employed. The liquefied metal was injected through the trachea, or a large bronchus, after the lung had been thoroughly warmed by immersion in water at 65°. The maceration was effected by means of 10 p.c. caustic potash.

For demonstrating the respiratory epithelia, the pulmonary tissue was filled with 0·2 p.c. silver nitrate, and afterwards hardened in upgraded alcohols, the material being kept in the dark the while. After the paraffin sections had been mounted in balsam or in glycerin, they were exposed to sunlight.

For demonstrating the pores in the alveolar walls, living animals were killed by confining them in an atmosphere of carbonic acid. This made the lungs perfectly atelectatic. They were then injected through the trachea with an aqueous solution of Berlin-blue and gelatin under very slight pressure.

Studying the Pollen-tube in Houstonia cœrulea.†—C. A. Matthewson fixed both old and young flowers in Flemming's fluid, chrom-acetic acid, and alcohol-acetic solution. The Flemming triple stain was used for the first two fixatives.

The tissue fixed in alcohol-acetic solution was stained with iron-alum-hæmatoxylin and Bismarck-brown. The latter method gave the best results. The sections were all 10 μ thick.

Studying the Cytology of the Entomophthoraceæ.‡—L. W. Riddle fixed most of the material in 0·75 p.c. chrom-acetic acid, which gave

* Archiv Mikrosk. Anat. u. Entwickl., lxix. (1906) pp. 1–61 (1 pl.).
† Bull. Torrey Bot. Club, xxxiii. (1906) pp. 487–93.
‡ Proc. Amer. Acad. Arts and Sci., xlii. (1906) pp. 177–97 (3 pls.).

satisfactory results except for the more mature stages of the resting spores, when it became necessary to use hot sublimate-acetic.

Flemming's weaker solution was also tried, but though not superior to the chrom-acetic mixture, gave excellent preparations after an immersion of some weeks. Paraffin sections of the hosts infected with the fungus were stained with safranin-gentian-violet. Heidenhain's iron-hæmatoxylin was a failure.

Studying the Histogenesis of the Retina.*—A. W. Weysse and W. S. Burgess tried several fixatives with varying degrees of success. Kleinenberg's picro-sulphuric mixture proved satisfactory, but the best results were obtained from 70 p.c. alcohol 90; glacial acetic acid 3; formalin 7. In this the embryos remained for one week, and were then transferred to 70 p.c. alcohol.

The eyes were dissected out, cut in halves by a vertical section through the optical axis, and placed in 90 p.c. alcohol for 3 hours, followed by 95 p.c. alcohol for from 6–12 hours, according to size. They were then cleared in cedar-oil, and imbedded in paraffin. The sections were stained either with a 33 p.c. aqueous solution of Delafield's hæmatoxylin followed by eosin, or by iron-alum followed by eosin. In the latter case, the slide was first placed in a 4 p.c. aqueous solution of iron-alum for 10 minutes. It was then thoroughly washed in tap-water, dipped in a saturated aqueous solution of hæmatoxylin for 10 minutes, and then again washed in water. This left the sections black. The slide was then placed once more in the iron-alum solution, and carefully watched until the sections were of a light purple tint. They were then rinsed in water, and examined under the Microscope.

If overstained, they were bleached a little longer in the iron-alum; if not stained enough, the hæmatoxylin was repeated. The slide was next placed in an alcoholic solution of eosin for about 15 seconds, and the excess of stain washed out in alcohol.

Studying the Gastrulation of the Horned Toad, Phrynosoma cornutum.†—C. L. Edwards and C. W. Hahn found that in order to obtain the earlier stages, it is necessary to take the eggs from the oviduct of the gravid female immediately after it has been chloroformed. The oblong eggs are cream-coloured, and when dry the shell becomes tough, but not brittle or stiff. To fix the embryos free from yolk and separated from the eggshell, a disk somewhat larger than the embryonic area was cut out. In removing this a considerable portion of the yolk immediately beneath was carried with it to sustain the embryo until it could be supported on all sides by physiological salt solution. By the use of a current from a pipette the yolk was removed and then the shell membrane and the vitelline membrane. Sometimes in very early stages it was found desirable to allow the shell-membrane to remain on the blastoderm for its support.

Usually a drawing of the unstained embryo was made under a magnification of 60 diameters in order to facilitate the interpretation of sections.

In general, Flemming's chrom-acetic-osmic acid followed by succes-

* Amer. Nat., xl. (1906) pp. 611–37 (17 figs.).
† Amer. Journ. Anat., v. (1906) pp. 331–51 (15 figs.).

sive alcohols was employed for fixing. A modification of Mayer's hæmalum was found to be superior to hæmatoxylin and other hæmatin stains, both for sections and specimens *in toto*. For the latter Mayer's hæmalum diluted with 20 parts of ammonia alum was used. The specimen was decolorised in 1–10 of 1 p.c. hydrochloric acid in 70 p.c. alcohol. Alcoholic cochineal gave good results *in toto*. Benzo-purpurin was advantageous in older stages. Orange G was used as a plasma stain on sections. The preparations were cleared in anilin or clove-oil, and afterwards in xylol.

Owing to the radially symmetrical appearance of the embryonic area in the earliest stages, they were difficult to orient. They were imbedded in celloidin, and then the celloidin was pared down until the embryos could be observed under a low power.

Triangular blocks were then cut with definite relation to the anterior and posterior ends of the blastoderm. They were then re-imbedded. The celloidin also acted advantageously in protecting the delicate embryos which had become brittle after several years in alcohol.

Demonstrating the Genitalia of Diptera.*—W. Wesché immersed newly killed insects in 15 p.c. caustic potash. When all but the membranes, the exoskeleton and the chitinous structures are dissolved, the preparations are thoroughly washed in water, and then placed in glacial acetic acid for 24 hours. They are again washed with water and then arranged on slides. Another slide is superimposed, and the two compressed by means of clips at both ends. If the arrangement is satisfactory the slides are tied at the ends with twine, the clips removed, and then immersed in methylated spirit for at least 24 hours. The preparation may, if desired, be now stained, for which purpose anilin-blue is recommended. It is now ready for transference to oil of turpentine : the slides are carefully removed, and then the object is removed with a section-lifter to turpentine, wherein it remains for at least 24 hours. After this it may be mounted in balsam, though some preparations are better for a further clearing in oil of cloves. Examination of the preparations should be made with a medium power ($\frac{1}{7}$) aided by a substage condenser.

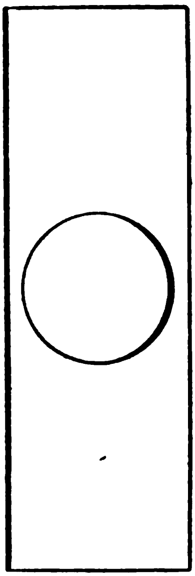
For dissecting under the Microscope, the end of the abdomen must be removed and placed in a drop of water in a live-box or compressorium (the cover being removed), and the organs teased apart by fine needles. The forcipes must be separated from their articulated bases, and the penis and appendages brought out free from the adhering muscles and duct. Impose a cover-glass and examine. Next take a $\frac{7}{8}$ in. cover-glass, place on it a small drop of spirit, and then, by means of a bristle or needle, the parts. Examine with lens, and, if the arrangement be successful, place some more spirit on the cover-glass and put it on a piece of white paper and both on the hot-plate, which must then be gradually heated. As the spirit evaporates it must be replaced with fresh ; a glass needle answers best for this purpose. When dehydrated, the preparation is treated with turpentine, and when cleared is mounted in balsam by superimposing another and thinner cover-glass. This $\frac{7}{8}$ in. glass when dry can be mounted

* Trans. Linnean Soc. (Zool.), ix. (1906) pp. 339-86 (136 figs.).

between three slips of cardboard, the upper and lower punched with a circular hole (fig. 82), and the middle cut to the shape of the larger cover-glass (fig. 83). They can be gummed together and placed in a press and permanently sealed by means of spirit varnish.

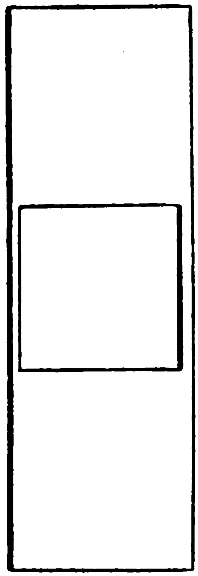
Dry and spirit-preserved insects must be soaked in water for a few hours before dissection.

Insects not larger than the common house-fly may be mounted



Lower and upper piece.

Fig. 82.



Middle piece.

Fig. 83.

whole without pressure. The initiatory stages are the same as the foregoing, but instead of being placed on a slip the insect is placed in a saucer on its back, and a little water poured in. After arranging in the desired position the water is replaced by spirit. When the insect is quite stiff, it is removed on a section-lifter to spirit in a closed flat-bottomed vessel. When thoroughly dehydrated it is removed to turpentine, and after 48 hours or so it is transferred to a slide and covered with balsam. Place round 3 or 4 glass beads or a glass ring which have been washed in alcohol and kept in turpentine. The cover-glass may now be put on and weighted down with a bit of lead. Run in more balsam and keep on doing so daily as the xylol evaporates.

This preparation is best suited for the binocular Microscope and low-power objectives; the position of the internal organs can be well seen in a successful preparation.

Method of Demonstrating Spirochæta pallida in the Blood.*— P. Ravaut and A. Ponselle take 30 c.cm. of distilled water in a test tube and add thereto 30 drops of the blood drop by drop. In about 3 hours a fibrinous clot entangling the white corpuscles and micro-organisms will have formed. The clot is withdrawn, washed several times to free it from any red corpuscles, rolled on filter-paper to remove superfluous water, then imbedded, sectioned, and stained by Levaditi's method.

In this way the writers found *Spirochætæ* in every section examined.

(3) Cutting, including Imbedding and Microtomes.

Cathcart-Darlaston Microtome.—This instrument, made by Watson and Sons, contains an addition to the ordinary well known Cathcart

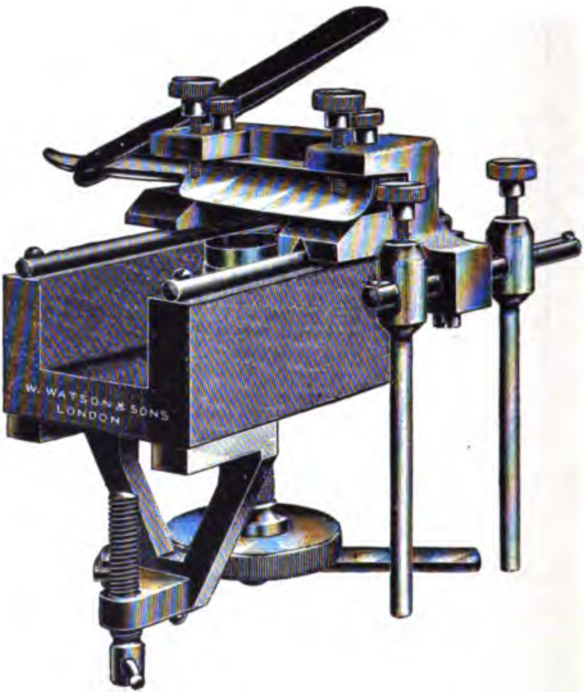


Fig. 84.

Microtome, consisting of an arrangement whereby the material to be cut is automatically raised (fig. 84). Two vertical forks, A A, are attached to the knife carriage, and as the latter is moved forward one of these forks catches an arm attached to the milled head below, thereby carrying a pawl the distance necessary to engage any desired number of teeth, according to the distance apart at which the two forks have been set.

* Gazette des Hôpitaux, 1906, p. 1023. See also Medical Review, ix. (1906) p. 517.

When the section has been cut, and the knife carriage is being drawn back, the arm on the milled head is carried backwards, thereby turning the milled head and raising the material for cutting. The automatic action can be thrown out of gear as desired, enabling the milled head to be rotated by the fingers as usual.

Darlaston Section Cutter.—This section cutter (fig. 85) is made of a solid brass rod $1\frac{1}{2}$ in. diameter, with a well $\frac{11}{16}$ in. diameter. It is claimed by the designer that sections can be cut with rapidity and accuracy, on account of the solid nature of the construction. It is made by Watson and Sons.

FIG. 85.

(4) Staining and Injecting.

Intra-vitam Staining of the Retro-cerebral Apparatus of Rotifers.*—P. M. de Beauchamp, in some further observations on the retro-cerebral apparatus of Rotifers, states that outside the sac, properly so-called, is a second formation having quite different anatomical characters. This subcerebral gland, which as a rule is only detectable in sections, becomes easily visible in the living animal by means of intra-vitam stainingwith neutral-red or with brilliant Kresyl blue.

New Method of Staining Plasma Cells.†—F. Federici prepares hot saturated aqueous solutions of safranin O, Grübler, and of "Lichtgrün." 60 c.cm. of the former are mixed with 20 c.cm. of the latter. The precipitate which forms is filtered off, the filtrate constituting solution A. The precipitate on the filter is washed several times with distilled water, and is then dissolved in 50 c.cm. of ordinary alcohol: this forms solution B. The final solution is made by mixing Mayer's hæmalum 40 c.cm., solution A 40 c.cm., and solution B 20 c.cm.

In the final solution the sections are placed for 1–3 hours. On removal they are washed for a few seconds in 1 p.c. iron-alum, then in distilled water, after which they are placed in absolute alcohol. Much safranin is herein removed, and when the sections have assumed a green tint the differentiation may be assumed to be complete. They are then passed through bergamot-oil, xylol, and finally mounted in balsam. By this method it is claimed that the nuclei are stained blue, the connective-tissue green, the cell protoplasm greenish-blue, the protoplasm of the plasma cells (Mastzellen) pink, and their basophile granules red.

Bielschowsky's Method of Staining Nervous Tissue.‡—R. Legendre has used this method with success, and finds that he obtains better results therefrom than from the procedure of Ramon y Cajal. Three modifications are given. The technique of the first consists (1) in

* Comptes Rendus, cxliii. (1906) p. 249.
† Anat. Anzeig., xxix. (1906) pp. 357–61. ‡ Tom. cit., pp. 361–7 (2 figs.).

fixing the pieces in 12 p.c. formalin for several days to months; (2) sections, 20 μ, made by the freezing method are immersed in 2 p.c. silver nitrate for 12–24 hours; (3) they are then passed through 3 p.c. ammonia for 10–20 seconds or until they assume a yellow tinge; (4) after which they are treated with 20 p.c. formalin for 10 minutes; (5) after passing again through 3 p.c. ammonia, they are dipped in 0·5 p.c. silver nitrate for ½ minute and (6) then treated with 20 p.c. formalin to reduce the silver; (7) they are next passed through 3 p.c. ammonia and then washed in 20 p.c. formalin for several minutes; (8) the next step is to treat the sections with the following solution, which imparts to them a violet hue: gold chloride 1 p.c. 2–3 drops, acetic acid 2–3 drops, distilled water, 10 c.cm.; (9) they are subsequently passed through 5 p.c. hyposulphite of soda which dissolves the unreduced silver nitrate; (10) after washing in distilled water and then passing through up-graded alcohols, they are treated with carbol-xylol, and finally mounted in balsam.

In the second method which is intended for impregnation *en masse* and paraffin sections, pieces less than 1 cm. thick are fixed in 12 p.c. formol and then immersed in 2 p.c. silver nitrate for 24–48 hours. After a quick wash in distilled water the pieces are treated for ½–1 hour with an ammoniacal silver solution prepared quite fresh in the following way: 20 c.cm. of 2 p.c. silver nitrate, and 2–3 drops of 40 p.c. soda are mixed; the black precipitate which forms is dissolved by adding ammonia, drop by drop. After washing in water the pieces are treated for 12–24 hours with 20 p.c. formalin, and then comes paraffin imbedding followed by the chloride of gold, and the subsequent stages detailed above.

The third method consists in fixing pieces less than 1 cm. thick in 10–15 p.c. formalin. Frozen sections 10 μ thick are made, and after being washed in distilled water are immersed for 24 hours in 2 p.c. silver nitrate. After a wash in distilled water the sections are treated for 15 minutes with an ammoniacal silver solution made as above but with 5 c.cm. 10 p.c. silver nitrate. Then follow 20 p.c. formalin, chloride of gold, hyposulphite of soda, etc., as before.

Method of Staining encapsuled Micro-organisms.*—A. Schädel stains the films for ¾–1 minute in ordinary carbol-fuchsin solution and then afterwards for 1 minute in the following solution: mercuric chloride, 0·1 grm.; water and alcohol, 25 c.cm. each. The micro-organisms are stained red, the capsules being colourless against the general pink ground. The stain is permanent. In staining sputa the preparations should be treated with the fuchsin solution for 1½ minutes and for 2 minutes with the mercuric chloride.

Staining Neuroglia in Ichthyobdella.†—C. Pérez and E. Gendre recommend that the material should be fixed in Borrel's chrom-osmic-platinum mixture, and the sections obtained with magenta-red, and then differentiated with picro-indigo-carmin. Some, such as *Branchellion*,

* Lancet, 1906, ii. p. 190.
† Proc. Verb. Soc. Sci. Phys. et Nat. Bordeaux, 1904–5, pp. 50–2.

are stained by a 1 p.c. solution of magenta-red in half an hour, and then differentiated for a similar length of time. Sections of *Pontobdella* take an hour to stain, but are differentiated in from 10–15 minutes.

Demonstrating the Presence of Negri's Bodies in Hydrophobia.* Anna W. Williams and May M. Lowden demonstrated the presence of Negri's bodies in the following way. Smears were made from the cerebral cortex of the Rolandic region, the cornu ammonis, and the cerebellum. The smears were air-dried, and then fixed in methyl-alcohol. Some were stained by Giemsa's method (azur ii.-eosin, 3 ; azur ii., 0·8 ; glycerin and methyl-alcohol, 250 each ; the glycerin and alcohol are heated to 60° ; the pigments are then dissolved in the alcohol and the glycerin added slowly, stirring the while. After standing all night, the mixture is filtered, and the solution is then ready for use. One drop of the stain to every c.cm. of distilled water made alkaline by the previous addition of one drop of a 1 p.c. solution of potassium carbonate to 10 c.cm. of the water). The solution made in the foregoing manner is poured over the smear and allowed to act for ½–3 hours, or even much longer. The excess stain is removed with tap-water ; the smear is then dried with blotting-paper.

Other smears were treated by Mallory's eosin-methylen-blue method : The smears are fixed in Zenker's solution for ½ hour, and after rinsing in tap-water are placed successively in 95 p.c. alcohol + iodin, ½ hour ; 95 p.c. alcohol, ½ hour ; absolute alcohol, ½ hour ; eosin solution, 20 minutes ; rinsed in tap-water ; methylen-blue solution, 15 minutes ; 95 p.c. alcohol, 1–5 minutes ; and then mopped up with filter-paper.

For sections the technique was as follows :—Fixation in Zenker's fluid for 3–4 hours ; tap-water, 5 minutes ; iodin-alcohol, 24–48 hours ; 95 p.c. alcohol, 24 hours ; absolute alcohol, 4–6 hours ; cedar-oil ; cedar-oil + paraffin 52°, 2 hours ; paraffin 52°, 2 hours. Sections 3–6 μ thick were dried in incubator at 36° for 24 hours, and stained by Mallory's eosin-methylen-blue method.

As depicted in the illustrations, the bodies stained by Mallory's method are red with one or more blue granules ; by the Giemsa method there is a thin peripheral zone of pink, inside this the body is bluish, the granules with which it is beset being red.

(5) Mounting, including Slides, Preservative Fluids, &c.

New Method of Mounting Fungi grown in cultures for the Herbarium.†—G. G. Hedgcock and P. Spaulding separate the fungi, and make pure cultures in Petri dishes upon a rather stiff agar made with some infusion suitable for the normal growth of the fungi. At the proper stage in their growth the plates are divided into square blocks of agar of a suitable size. Each of these blocks is placed right side up on stiff cardboard, and allowed to dry down. After the agar has become dry the mount is protected by pasting over the agar block a small square or circular piece of cardboard which has been perforated with a gun-wad cutter, the perforation being of a size necessary to include the mounted

* Journ. Infectious Diseases, iii. (1906) pp. 452–83 (4 pls.).
† Journ. Mycol., xii. (1906) p. 147.

block. These squares or circles of cardboard may be made of board of several thicknesses, varying from one to several millimetres, so that in selecting a protector the thickness may be adapted to the height of the filaments of the fungus. This method of mounting has proved very convenient for specimens of *Stilbum*, *Grophium*, *Ceratostomella*, and other fungi. It is advisable to poison the specimen after mounting by spraying it with a strychnin solution.

(6) Miscellaneous.

Immersion Oil Bottle.*—Watson and Sons claim that this form of oil bottle (fig. 86), which is constructed on the lines of the unspillable inkpot, possesses the advantage of its prototype, and is also very clean. The cover is made of boxwood, and from its middle a wooden rod for obtaining a drop of oil passes down to near the bottom of the tube.

Fig. 86.

Watson's "Facile" Turntable with Ball-bearing.†— In this new turntable (fig. 87) the rotating table is below the level of the supporting block, which is higher than in ordinary models. The centre pin is of hardened steel, and the table at the centre where the pin comes in contact, is fitted with a hardened steel ball. As the pin and ball only engage at a small point, the action is so free that a slight push will make the table rotate for a considerable time. On the surface of the table is engraved a ring of such diameter that when a 3 in. by 1 in. slide is central on the table, the four corners exactly touch the circumference of the circle.

Fig. 87.

Microchemical Test for Zinc.‡—H. C. Bradley states that when a moderately concentrated solution of a zinc salt is treated with sodium nitro-prusside, there is thrown down a salmon-pink precipitate of zinc nitro-prusside, the characteristic feature of which is its definite and readily identified crystal form. All other nitro-prussides of the heavy metals which are insoluble in water are amorphous, slimy precipitates resembling the ferro-cyanides in general physical properties. Though the reaction is not new, its possibilities as a reliable test for zinc appear

* Watson and Sons' Catalogue, 1906, p. 104. † Special Catalogue, p. 10.
‡ American Journ. Sci., xxii. (1906) pp. 327–8.

to have been overlooked. It was found to be valuable in determining the presence of zinc in certain marine Gastropods, and by its means zinc was detected readily in the blood of these Molluscs in a few minutes, while the tests in ordinary use require many hours and much material. In the solutions of tissue ash used the copper was first removed by means of H_2S, and the filtrate concentrated to a small bulk. A drop of this solution was then placed on a Microscope slide and digested with a drop of freshly prepared nitro-prusside solution. On cooling, the rectangular plates and prisms of the zinc salt were deposited.

Gelatin Mass for Fixing and Mending Bone Preparations.*—C. Skoda has found that the following mixture makes an excellent fixative and reparative for uniting and repairing bones intended for museum and demonstration purposes. The adhesive consists of isinglass 2·0, white dextrin 1·0, zinc oxide 0·1.

It is not advisable to make more than is necessary, as the mass does not keep well. It may be thinned by dilution with water if necessary, e.g. it requires to be thin for fixing a weasel's tooth in the jaw and thick for a lion's.

Hardening of Organs with Formalin.†—V. L. Neumayer hardens brain and other organs by means of formalin, and obviates the disagreeable vapour with ammonia. The method is chiefly intended for brain, which is immersed for about three weeks in 10 p.c. formalin. The viscus is then placed for eight days in 12·5 p.c. ammonia, after which it is soaked in strong hydrochloric acid, diluted ten times, from eight to fourteen days; usually eight are sufficient.

Instead of hydrochloric, nitric acid diluted five times may be used.

It is advisable to test the acid solution from time to time, and renew it if the acidity be diminished or lost.

Metallography, etc.

Questions in the Chemistry of Iron.‡—H. von Jüptner deals with the physical chemistry of the alloys of iron, considering the iron-carbon system somewhat fully. The general theory of the solidification of solutions and alloys is outlined. Pure iron may exist in at least four modifications: above 1550° C. liquid, 1550°–900° γ, 900°–760° β, below 760° α. Liquid iron is capable of holding 4·3 p.c. carbon in solution at 1136°, more at higher temperatures; γ-iron dissolves 0·95 p.c. at 700° to 2 p.c. at 1136°; β-iron appears to dissolve about 0·15 p.c. at 760°; while carbon is nearly if not quite insoluble in α-iron. It is found that on dissolving pig-iron, steel, etc., in dilute nitric acid, the power of the combined carbon to colour the solution varies greatly in different cases. These facts, together with others, lead to the conclusion that there are four varieties of combined carbon: Fe_3C, Fe_2C, hardening carbon in annealed steel, and hardening carbon in hardened steel. The conditions of equilibrium between Fe and Fe_3C, Fe and Fe_2C, Fe and C,

* Anat. Anzeig., xxix. (1906) pp. 380-2. † Tom. cit., pp. 378–9.
‡ Ber. Deutsch. Chem. Ges., xxxix. (1906) pp. 2376-2402 (15 figs., 7 photomicrographs).

are considered, the order being that of increasing stability. The changes in the equilibrium curves necessitated by the supposition that α-iron and β-iron are capable of holding carbon in solution, are dealt with. The alloys of iron with silicon, phosphorus, carbon and phosphorus, and nickel, are briefly considered.

Copper Steels.*—P. Breuil gives the results of shock tests on notched bars, torsion tests, and hardness measurements of copper steels. In the low carbon steels the presence of copper appears to reduce the capacity of resisting shock. Elastic limit in torsion and work expended in rupture, are raised when the copper exceeds 2 p.c. Corrosion tests were made by determining the loss of weight resulting upon immersion in dilute sulphuric acid for one month. The loss was smaller with increase of copper up to 2 p.c. Stead's conclusions are confirmed by the author's microscopic examination of the steels. With more than 4 p.c. copper, red nodules of high copper content are isolated in the ingots. The structure of the steels capable of being utilised—i.e. containing less than 4 p.c. copper—is remarkably fine. These steels contain more granulo-sorbitic pearlite as the copper content is higher.

Brittleness and Blisters in Thin Steel Sheets.†—E. F. Law found, by microscopical examination, that brittle and blistered sheets were invariably of less pure steel than tough sheets. The steels from which the defective sheets had been rolled, showed marked segregation and contained oxide of iron. The oxide of iron, which always appears to be associated with blistered sheets, is reduced by nascent hydrogen in the pickling bath, with the formation of water vapour. During annealing the action is reversed, the water vapour being decomposed and hydrogen liberated. The internal pressure produced by these reactions is sufficient to cause the formation of blisters. Brittleness is frequently due to "ghost lines" rich in sulphur and phosphorus. The same plate may have a wide range of ductility.

The Relation between Type of Fracture and Micro-structure of Steel Test-pieces.‡—C. O. Bannister has selected typical fractures from a large number of broken tensile test-pieces and compared the mechanical tests, chemical analysis, and microscopic constitution. His main conclusions are: (1) cup fractures are obtained with homogeneous, minutely crystalline or granular steel, free from slag and manganese sulphide; (2) laminated fractures are due to slag lines (manganese silicate or sulphide) or "ghost lines"; (3) steels giving irregular fractures are generally inferior in quality, made up of irregular patches of pearlite and ferrite, nearly always accompanied by slag lines; (4) the size of the crystals in crystalline fractures has a distinct relationship to the micro-structure of the steel.

Progress of Metallography since 1901.§—F. Osmond and G. Cartaud give a comprehensive review of recent research in metallography. The first paper covers the period 1901–4, the second 1904–6.

* Comptes Rendus, cxliii. (1906) pp. 377–80. See also this Journal, 1906, p. 516.
† Journ. Iron and Steel Inst., lxix. (1906, 1) pp. 134–60 (7 figs.).
‡ Tom. cit., pp. 161–78 (25 figs.).
§ Internat. Assoc. for Testing Materials, Brussels Congress, 1906, 86 pp., 28 figs.

The authors point out that the micrographical study of alloys has become a branch of physical chemistry. The subject is dealt with under the following headings:

1. *Technique of Metallography.*—The progress made by Le Chatelier and others is indicated.

2. *Equilibrium Curves.*—The earlier paper includes an account of Heycock and Neville's well known work on the complex copper-tin system. The iron-carbon system is considered somewhat fully in both papers. In the second the valuable researches carried out in the laboratory of G. Tammann are summarised. The constituents of iron-carbon alloys are defined, and the conditions necessary to produce them stated.

3. *Modifications of One Isolated Phase or of a Complex of Phases within their Regions.*—Thermal and mechanical treatments. This section deals chiefly with researches on modes of deformation of metals.

It is here only possible to give a very imperfect account of these papers. As a guide to the literature of metallography of the last six years they should be of great value to the student. They derive additional importance from the fact that one of the authors is the foremost authority on the subject.

Quaternary Steels.*—L. Guillet gives in detail the results of extensive researches on alloys containing iron, carbon, and two other elements (nickel, manganese, chromium, vanadium, etc.); 250 alloys were examined, micrographically and mechanically, following the author's usual plan. The Guillery machine was employed for the shock tests. The steels are classified according to microstructure, and the mechanical qualities corresponding to each type of structure are indicated. The effect of heat treatment (quenching, etc.) on steels of each class is stated. Certain structures indicate the presence of certain elements, e.g. graphite usually demonstrates the presence of silicon in fairly high proportion. The structure may be simple, only one constituent being present, or complex, with two or more constituents. Martensite and γ-iron are the simple structures. Nickel, manganese, chromium, tungsten, and molybdenum tend to convert pearlitic steels into martensitic, while vanadium, silicon, and aluminium act in the opposite way. Martensitic steels, and steels containing graphite, are useless in practice; γ-iron steels are difficult to machine. For general purposes pearlitic steels are the only useful class.

Deformation and Fracture in Iron and Steel.†—By straining a piece of ductile metal, one surface of which has previously been polished, slip bands are developed on the polished surface. Controversy as to the true nature of these slip bands has arisen. A method for studying their configuration has been introduced by W. Rosenhain, who here gives further details and numerous results obtained by its application. The method is also adapted for examining the surface of fractures. The specimen to be examined is imbedded in electro-copper. The composite mass is cut through approximately at right angles to the surface to be

* Journ. Iron and Steel Inst., lxx. (1906, 2) pp. 1-141 (145 figs.).

† Tom. cit., pp. 189-228 (25 figs.). See also this Journal, 1905, p. 391.

examined, and polished. In this section the boundary line between the specimen and the copper constitutes a sectional view of the original surface of the specimen. A thickness of $\frac{1}{8}$ in. of deposited copper is sufficient. The author's results support the view, with some reservations, that plastic deformation in metals takes place by slip and twinning alone. A modified form of Beilby's theory, that by mechanical disturbance of the molecular arrangement of a crystalline solid, a crystalline phase may be converted into an amorphous phase, is supported. The well known phenomenon of the transformation of γ-iron when strained was studied on a 20 p.c. nickel steel. The changed constituent was found to occur only upon surfaces of slip.

Hardness of the Constituents of Iron and Steel.*—H. C. Boynton has employed Jaggar's micro-sclerometer to measure this property. The instrument was originally introduced for measuring the hardness of minerals. It consists essentially of a diamond point of constant dimensions, which is rotated at a uniform speed and under a given load on the section to be examined. The number of rotations required to bore to a given depth is determined : this quantity is a measure of the hardness (resistance to abrasion). The instrument is adjusted to the Microscope, and has suitable mechanical devices for recording depth of hole, number of rotations, etc. The author uses a second Microscope, with its axis horizontal, for measuring directly the downward movement of a micrometer scale attached to the arm carrying the diamond point. Considerable differences were found in the hardness of the same constituent in different steels, and in the same steel differently treated. The following hardness numbers are selected from a table given by the author: ferrite 460–1643; pearlite 842–4711; sorbite 2400–24,650; troostite 40,564; martensite 17,896–120,330; austenite 47,590; cementite 125,480.

ADAMSON, E.—**Influence of Silicon, Phosphorus, Manganese, and Aluminium on Chill in Cast Iron.** *Journ. Iron and Steel Inst.*, lxix. (1906, 1) pp. 75–105 (5 figs.).

ARNOLD, J. O., & F. K. KNOWLES—**Preliminary Note on the Influence of Manganese on Iron.** *Tom. cit.*, pp. 106–24 (1 fig.).

ARRIVAUT, G.—**Constitution of Manganese-Silver Alloys.** *Proc. de la Soc. des Sci. Phys. et Nat. de Bordeaux*, 1904–5, pp. 9–14.

" " **Preparation and Properties of Manganese-Antimony Alloys.** *Tom. cit.*, pp. 85–9.

" " **Bismuth-Manganese Alloys.** *Tom. cit.*, pp. 89–98.

" " **Manganese-Tin Alloys.** *Tom. cit.*, pp. 104–8

" " **Manganese-Lead Alloys.** *Tom. cit.*, pp. 108–10.

" " **Manganese-Platinum Alloys.** *Tom. cit.*, pp. 147–8.

" " **Manganese-Copper Alloys.** *Tom. cit.*, pp. 148–51.

AST, W.—**International Researches in Macroscopic Examination (Etching Tests) of Iron.** *Internat. Assoc. for Testing Materials, Brussels Congress*, 1906, 42 pp., 27 figs.

* Journ. Iron and Steel Inst., lxx. (1906, 2) pp. 287–318 (8 figs.).

BRINELL, J. A., & DILLNER, G.—**The Brinell Hardness Test and its Practical Application.** *Internat. Assoc. for Testing Materials, Brussels Congress*, 1906, 27 pp., 7 figs.

BRUNTON, J. D.—**The Heat Treatment of Wire.** *Journ. Iron and Steel Inst.*, lxx. (1906, 2) pp. 142–56 (40 figs.).

HATFIELD, W. H.—**Influence of the Condition of the several Varieties of Carbon upon the Strength of Cast Iron as Cast and Heat-treated.** *Tom. cit.*, pp. 157–88 (26 figs.).

HEYN, E.—**Methods of Etching Malleable Iron for the Visual Investigation of Structure.** *Internat. Assoc. for Testing Materials, Brussels Congress*, 1906, 32 pp., 62 figs.

ROBERTS, E. G. L., & E. A. WRAIGHT—**The Preparation of Carbon-free Ferro-Manganese.**

[An account of the authors' researches on the constitution of ferro-manganese forms part of this paper.]

Journ. Iron and Steel Inst., lxx. (1906, 2) pp. 229–86 (12 figs.).

SAUVAGE, E.—**Impact Tests on Notched Bars.** *Internat. Assoc. for Testing Materials, Brussels Congress*, 1906, 20 pp.

TURNER, T.—**Volume and Temperature Changes during the Cooling of Cast Iron.** *Journ. Iron and Steel Inst.*, lxix. (1906, 1) pp. 48–74 (9 figs.)

VIGOUROUX, E.—**Attempts to Prepare Iron-Bismuth Alloys.** *Proc. de la Soc. des Sci. Phys. et Nat. de Bordeaux*, 1904–5, pp. 71–6.

„ „ **Iron-Lead Alloys.** *Tom. cit.*, pp. 76–9.

„ „ **Iron-Antimony Alloys.** *Tom. cit.*, pp. 79–85.

„ „ **Iron-Tin Alloys.** *Tom. cit.*, pp. 99–104.

„ „ **Iron-Copper Alloys.** *Tom. cit.*, pp. 119–22.

„ „ **An Iron-Platinum Alloy.** *Tom. cit.*, pp. 136–9.

„ „ **Iron-Aluminium Alloys.** *Tom. cit.*, pp. 139–43.

WIGHAM, F. H.—**The Effect of Copper in Steel.** *Journ. Iron and Steel Inst.*, lxix. (1906, 1) pp. 222–32.

The Microscopy of Metals. *English Mechanic*, lxxxiv. (1906) pp. 230–1.

The Metallurgical Department of the Sheffield University. *Nature*, lxxiv. (1906) pp. 541–3 (1 fig.).

PROCEEDINGS OF THE SOCIETY.

MEETING

HELD ON THE 17TH OF OCTOBER, 1906, AT 20 HANOVER SQUARE, W., A. N. DISNEY, ESQ., VICE-PRESIDENT, IN THE CHAIR.

The Minutes of the Meeting of the 20th of June, 1906, were read and confirmed, and were signed by the Chairman.

The List of Donations to the Society since the last Meeting (exclusive of exchanges and reprints), was read, and the thanks of the Society were voted to the donors.

	From
Science Progress, No. 1	*The Publisher.*
Recueil de l'institut Botanique Leo Errara. Tomes i. et vi. (8vo, Brussels, 1906)	*The Director of the Institute.*
A. Lingard, M.B., and Major E. Jennings, I.M.S., Some Flagellate Forms found in the Intestinal Tracts of Diptera and other Genera. (8vo, London, 1906)	*Mr. A. Lingard.*
A large number of Slides of Microscopic Objects Catalogue of the same, with sketches Some materials for mounting On the Anatomy and Physiology of the Spongiadæ, by J. S. Bowerbank, LL.D., etc. Phil. Trans., 1858 Book containing mounted tracings of Sponge Spicules from the above paper Small portfolio containing drawings by Mr. Hilton of Diatoms, etc., from the Indian Ocean, Red Sea, and Arabian Sea	*Mr. Jas. Hilton, F.R.M.S.*
Slides (23) of Foraminifera from the Gault of Folkestone, used by the donor in writing his paper on the Foraminifera of the Gault of Folkestone	*Mr. F. Chapman.*
Old Portable Microscope by Dollond	*Major F. R. W. Sampson.*
Pocket Microscope	*A Member of the Quekett Microscopical Club.*

Descriptions of the Old Microscope by Dollond, and of the small pocket Microscope presented to the Society, written by Mr. F. A. Parsons, were read by the Secretary.

The Chairman said they were much indebted to Mr. Parsons for these interesting descriptions, and to the donors of the instruments, to whom a vote of thanks was unanimously passed.

Mr. Beck, being called upon to exhibit and describe a new form of optical bench which had been brought to the Meeting for the purpose, asked to be allowed to defer the description to a future occasion, as owing to the electric current available not being suited to the lamp he had brought, it was not then possible to exhibit the apparatus effectively.

Mr. J. H. Agar Baugh exhibited an immersion spot lens, made by Reichert, of Vienna, which was used to show the Brownian movement of very small particles in the blood. This it did very effectively.

Mr. F. W. Watson Baker exhibited a new metallurgical Microscope designed by Messrs. Watson and Sons, for the use of students; also a Cathcart Microtome with automatic action for raising the material to be sectioned; also a Microtome for cutting sections by hand, and a sliding bar stage fitted with ball-bearings.

Mr. James Murray's paper "On some Rotifera from the Sikkim Himalaya," was, in the absence of the author, read by Mr. C. F. Rousselet, who expressed the pleasure with which he had received this communication, more especially as he remembered only one previous paper upon the Rotifera of India.

On the motion of the Chairman, a vote of thanks was unanimously passed to Mr. Murray for his paper, and to Mr. Rousselet for reading it to the Meeting.

Mr. J. M. Coon read a paper "On *Cornuvia serpula*, a species of Mycetozoa new to Britain"; the subject being illustrated by lantern slides, and by specimens exhibited under Microscopes in the room.

The thanks of the Society were voted to Mr. Coon for his very interesting paper.

Mr. A. E. Conrady gave an account of an early criticism of the Abbe theory contained in a paper published in 1880 by Dr. Altmann, who maintained that the image should be considered as built up of diffusion disks such as Helmholtz had dealt with in his paper of 1873, and that in cases where the objective was not filled with direct light the latter was diffused by the object so as to utilise the otherwise dark space, and that the whole aperture was thus more or less completely utilised, with the result of a somewhat modified form of spurious disk. Altmann had thus tried to extend the Helmholtz theory.

The chief interest of this paper now lay in the fact that it brought an immediate and very vigorous reply from Professor Abbe in which the latter added very considerably to his previously published account of his theory, and in which he laid particular stress on the difference between a self-luminous object and one illuminated artificially. It was also interesting to note that this was a complete anticipation of Mr. Gordon's "antipoint" theory, so that one might say, that Professor Abbe had replied to Mr. Gordon's paper more than twenty years before it was read.

Dr. Hebb asked if Mr. Conrady was assured that Altmann's diffusion-disks were exactly the same things as Mr. Gordon's antipoints. The reply was in the affirmative.

The thanks of the Society were unanimously voted to Mr. Conrady for his communication.

The Secretary read a letter from Mr. W. P. Dollman with reference to his previous communication to the Society on stereoscopic photographs of objects under the Microscope. Mr. Dollman's communication was printed *in extenso* in the October number of the Journal, pp. 605–8.

A letter was read from Mr. Mestayer, who stated that he had a quantity of diatomaceous and foraminiferous earths for distribution and exchange. Any Fellows desiring to have any of this were asked to apply to Mr. Parsons.

The Chairman said that the Society had received a large number of slides of Foraminifera and other objects, and invited the assistance of any Fellows of the Society or Members of the Quekett Club in the work of sorting out and arranging this collection.

The following Instruments, Objects, etc., were exhibited:—

The Society:—An old portable Microscope by Dollond, and a small pocket Microscope.

Mr. J. H. Agar Baugh:—An Immersion Spot Lens made by Reichert.

Messrs. Watson and Sons:—Watson's Junior Metallurgical Microscope; The Cathcart-Darlaston Microtome; Darlaston Hand Section Cutter; Watson's Ball-bearing Sliding Bar.

Mr. C. F. Rousselet:—Slides of mounted Rotifers sent by Mr. Jas. Murray to illustrate his paper:—*Callidina angusticollis* var. *attenuata*; *C. formosa*; *C. longirostris*, var. *fimbriata*; *C. multispinosa*; *C. perforata*.

Mr. J. M. Coon:—The following slides of *Cornuvia serpula*: Formation of Spores, Elaters, Plasmodicarp, Sclerotium; and Lantern Slides illustrating his paper.

New Fellows:—The following were elected *Ordinary* Fellows of the Society:—Messrs. Henry James Aitken, and Otto Juettner.

MEETING

HELD ON THE 21ST OF NOVEMBER, 1906, AT 20 HANOVER SQUARE, W.
A. N. DISNEY, ESQ., M.A., B.SC., VICE-PRESIDENT, IN THE CHAIR.

The Minutes of the Meeting of the 17th of October, 1906, were read and confirmed, and were signed by the Chairman.

The List of Donations to the Society (exclusive of exchanges and reprints) received since the last Meeting, was read, and the thanks of the Meeting were voted to the donors.

	From
Cotton, A., and H. Mouton, Les Ultramicroscopes et les Objets Ultramicroscopiques. (8vo, Paris, 1906) ..	*The Authors.*
Gilman, A. D., The Habits, Anatomy, and Embryology of the Giant Scallop (The University of Maine Studies, No. 6). (8vo, Orano, Maine, 1906)	*The Author.*
Wright, Sir A. E., The Principles of Microscopy	*The Publishers.*
An Old Microscope by Dollond	*Mr. Chas. Lees Curties.*
A Culpeper Microscope	*Mr. Wynne E. Baxter.*

With reference to these donations, the Chairman called special attention to the book, "The Principles of Microscopy," which had evidently been written from a rather unusual point of view. It was illustrated by coloured plates, and looked like a book of more than ordinary interest.

Mr. C. F. Rousselet read a description of the two Old Microscopes presented to the Society—one being an original Culpeper Microscope by the Treasurer, and the other an old Cuff Model, made by Dollond, by Mr. C. L. Curties—and observed that the last named possessed a handle, a feature recently brought out again as a novelty.

The thanks of the Society were voted to Mr. Rousselet for his communication.

Mr. Conrady said it was interesting to note in these two old Microscopes the large size body-tube in the Culpeper form and the handle to the Cuff pattern—both of which things had been recently revived as improvements to modern instruments by Messrs. Zeiss.

Dr. Hebb exhibited a new porcelain filter made by Messrs. Doulton, of Lambeth. It had been carefully tested by Dr. Bullock and Dr. Crau, and found to be quite equal to the Chamberland filter. It was suitable for laboratory work and also when fitted on taps for domestic purposes.

Dr. Hebb also exhibited a filter devised by Mr. Taverner for obtaining clear mounting and other media, and read a description of the apparatus.

The thanks of the Meeting were voted to Dr. Hebb for bringing these matters before the Society, and to Messrs. Doulton and Taverner for their exhibits.

Mr. Conrad Beck exhibited an optical bench, which having been shown on a former occasion he did not think it necessary to describe. It was on that occasion fitted with a Nernst lamp with single filament, and a diffraction grating, giving a brilliant spectrum, any particular portion of which could be admitted to a Microscope by altering the position of a slit cut through an opaque screen placed in the path of the beam. In this instance it was arranged to show experimentally how *Amphipleura pellucida* could be resolved by the green light, whilst the yellow was unable to do this.

The thanks of the Meeting were voted to Mr. Beck for this exhibit.

Mr. Poser exhibited a special pattern Microscope, constructed by Messrs. Zeiss, chiefly for photomicrography in metallurgical work,* and the thanks of the Meeting were given to Messrs. Zeiss for sending this for exhibition.

Mr. Gordon read his paper, "On the Use of a Top Stop for Developing Latent Powers of the Microscope," and exhibited and briefly described his apparatus—which had been previously shown to the Society in a rather less complete form, and is described in this Journal.† He then pointed out that a top stop enables the microscopist to vary the proportion between the refracted and the unrefracted light which passes the instrument, and thus to render conspicuous a particular feature of the object, and to accomplish this with great nicety. In illustration of the results thus reached he exhibited a number of photographs taken with an achromatic oil immersion objective of N.A.$=1$. A series of pictures of *Pleurosigma formosum* showed how the features of an image change with change of aperture, and a photograph of *P. angulatum* showing the "white dot growing up within the black dot," was exhibited to demonstrate how, by means of a top stop, the objective in question could be made to equal the performance of an objective of much wider aperture. Finally a photograph of *Staphylococcus* was exhibited in which the stained spherules, characteristic of the object, were seen held together by a little mass of unstained enveloping jelly, very conspicuous and unmistakable in the image formed by the stopped beam, but barely discernible in the image formed by an unstopped beam, even with a lens of the highest power and largest numerical aperture. In the course of reading the paper he announced that Mr. Crouch had just shown him

* This Microscope was described and illustrated in the Journal for October, pp. 598–600.

† See *ante*, p. 157; and for diagram, p. 365.

a very interesting extract from the American Quarterly Microscopical Journal, Vol. I., No. 1, published at New York in October 1878, in which Professor Wm. Lighton had proposed the use of a very minute aperture placed in the Ramsden disk for the purpose of cutting down the diameter of the transmitted beam and so obtaining oblique or otherwise modified illumination, but observed that the Professor did not seem to have noticed the advantages resulting from the use of a central stop in that position.

Mr. Rheinberg said that, in considering Mr. Gordon's paper, of which he had had the advantage of seeing an advance proof, he thought the main point we had to keep before us was that the use of a stop in the Ramsden circle of the Microscope was from an optical point of view precisely equivalent to the use of a stop in the upper focal plane of the objective.

That any opaque spot which put out of use the central portion of the objective, and cut off the whole or a portion of the direct light beam from the condenser, deteriorated and falsified the image, had been so often demonstrated and proved theoretically and practically during the last thirty years that it seemed to him to be waste of time to go over the ground again. To contend differently was to contend against the elementary principle, which was common to all theories of the Microscope, that image formation in an optical instrument was brought about by the reunion of a multitude of light rays, from the object points, bearing definite phase relationship to one another. One could not with impunity cut out the central portion of these rays, without gravely disturbing the result in the neighbourhood of the true image points, for one is liable to get triplication and duplication of lines and intercostal markings, besides the intrusion of other detrimental features.

He himself had warned against some of the damages in his paper on colour illumination, before this Society about ten years ago, and that evening he had on the table a slide of familiar diatoms, and also a grating (Grayson's band plate) shown under the Microscope with an objective and Mr. Gordon's top stop apparatus fitted with opaque stops, from which they could see for themselves what false and incorrect images were produced. But better examples of these false effects could not be found than those which Mr. Gordon had himself shown them on the screen that evening in the case of *P. formosum* and the slide of bacilli.

Curiously enough *P. angulatum* formed, under circumstances, somewhat of an exception. The reason for this could be readily enough explained, though he would not detain the Meeting by entering into them that evening.

Now, whilst it seemed to him that the application of the top stop apparatus as advocated by Mr. Gordon was entirely misplaced, he for one was grateful to him for having devised the ingenious little piece of apparatus itself. It lent itself admirably to various kinds of optical experiments, but chiefly, he feared, to those which disproved his own ideas —for all the Abbe experiments in connection with the diffraction theory could be repeated with it. It would also, he hoped, turn out to be a convenient apparatus for colour illumination by the diffraction method.

He had been experimenting with it for the latter purpose since some time with promising results, but was still troubled by difficulties connected with producing disks so that the normal phase relationship between the rays passing the central and peripheral portions of the disks might not be disturbed. How sensitive the image was, even to slight alterations or disturbances in this respect, those who had made it the subject of careful experiment would appreciate.

Proposals which ignore that important and vital matter altogether were obviously quite untenable.

One other point: moving the opaque stops over the Ramsden disk in order to find out which parts of the object were refracting light in a particular direction seemed an interesting experiment, but whilst that might apply to the comparatively coarse structure, the question arose whether that lent itself to deductions in the case of the relatively fine structure, because these gave rise to extensive diffracted beams, which were not covered by the stop, but which must be taken into account.

Mr. Conrad Beck said he was rather surprised to hear Mr. Rheinberg say that putting a stop at the posterior focus of the object-glass would produce similar results, because (as illustrated by a diagram which he drew upon the board) a patch stop placed in that position so as to form a ring of light in the exact centre, will cut off the edge of oblique rays and give a crescent of light at all positions except the exact centre of the field, and it seemed hopeless to find any position except the Ramsden circle where a patch stop could satisfactorily be introduced. Probably the next best place would be on the front surface of the object-glass, but the practical difficulties of this method would not be easy to overcome.

One great advantage of a discussion such as that before the meeting, seemed that it lifted the subject away from the interminable gratings, and drew attention to the fact that the resolution of objects which were gratings was quite a different thing from that of objects which were not gratings, and the application of the Microscope to practical uses did not lead to the examination of gratings, but to that of objects of irregular contour. He thought no one acquainted with the subject could fail to be struck with the fact that Mr. Gordon's photographs were taken with a lens of 1·0 numerical aperture. The subject was one of much interest, and was worth a great deal more attention than it had yet received. It was interesting to note that if they followed the course of the rays through the whole Microscope, they would find there was only one disk through which all the rays passed symmetrically, and that was in the Ramsden circle.

Mr. Conrady said there were many points in the paper which invited discussion, but he must limit himself to a few.

Mr. Gordon had once more repeated his idea that the well-known visibility of single minute objects proved the accepted limits of resolution to be wrong. The fact, of course, was that visibility and resolution were quite different things; the former was merely a question of contrast, an object being seen if it contrasted sufficiently with its background, no matter how small the former might be. For ages men had observed the stars, which, according to present knowledge, were in probably all cases below $\frac{1}{100}$ second of arc in apparent size; the limit of resolution for the

naked eye being about sixty seconds, we had here visibility of objects measuring less than $\frac{1}{8000}$ part of the closest distance at which two such objects could be seen separated or resolved.

It seemed to him that the "delicate tracery" on diatoms which Mr. Gordon was so proud of, would be recognised as spurious appearances of the intercostal order, which disappeared when critical illumination was employed.

As regarded the question of annular apertures, these had been shunned by astronomers because the assumed theoretical advantage was not borne out in practice; with the unbroken full aperture practically all the light was concentrated in the central part of the spurious disk, the outer rings being almost invisible; with an annular aperture, on the contrary, a great part of the light was transferred from the central disk to the rings, which became so bright as to prevent any increase of resolution from being obtained.

It was also worth remembering that the complicated image of *Pleurosigma angulatum*, which was calculated as the theoretical result of the co-operation of the six diffraction spectra, and which was realised by Abbe and Stephenson, could only be obtained by the use of an equivalent to Mr. Gordon's top-stop; and the same was true of all the most startling false images obtained with Abbe's diffraction plate.

He could not help thinking that the latent power of the Microscope which the top-stop developed was the already great power of the Microscope to deceive.

Mr. Maurice Blood was much interested in the appearance shown in the photographs of the bright jelly ring round the bacilli when the top stop was used, but thought it curious that the folds (creases) in the blood film were surrounded by a similar appearance.

He suggested that these experiments should be repeated with apochromatic objectives, to make certain that the effects were not produced by differences in the correction of the central and marginal zones of the objective. He also thought it was not quite fair to compare a narrow central beam with wide annular illumination.

Mr. Gordon said he thanked all who had taken part in this discussion, and, not least, those who had subjected his paper to a searching criticism, because this was the only way in which the merits of a new proposal could be tested. Mr. Rheinberg had said that a top stop was equivalent to a stop placed in the upper focal plane of the objective. That was roughly correct, but it must be taken subject to the criticism which Mr. Beck had passed upon it, and subject also to this further point of difference, which for practical purposes was important—namely, that in the back focal plane of the objective you have to deal with spherical wave-fronts, whereas in the Ramsden disk the wave-fronts are plane wave-fronts. It follows that if a plate of glass is employed to carry the stop, and is introduced into the back focal plane, it will disturb the corrections, but in the Ramsden disk it will disturb nothing. In a finely adjusted instrument, therefore, a stop cannot be usefully placed in the back focal plane, and the Ramsden disk is the only possible position for it. But that was a point which did not enter, as he understood it, into Mr. Rheinberg's argument, and he thought that, for the

purposes of that evening's discussion, it was quite possible to accede to Mr. Rheinberg's proposition. Then it had been said that the markings shown in the photographs exhibited might be intercostal markings, but that was a mistake. It was easy to distinguish intercostal markings from objective features by varying the angle of the transmitted beam, as, for example, by altering the iris diaphragm, and he could assure them that he had not shown any intercostals that evening.

Referring to Mr. Conrady's criticisms, and in particular to his reference to the abandonment by astronomers of the annular aperture, he pointed out that there was a great difference in this respect between the telescope and the Microscope, and that wholly different considerations came into account when it was a question of applying the annular aperture to the one or the other instrument. In the case of the telescope, the object-glass was evenly illuminated all over by light received in the form of plane wave-fronts from an object the absolute illumination of which the observer could in no way control. In the case of the Microscope, a large proportion of the objects with which we deal do not throw their light evenly upon the object-glass at all, but send it forward in broken beams, which impinge at various points upon the face of the objective. Hence, in the case of the Microscope, a stop affects different parts of the picture in different ways, and may be used to darken the field in contrast with a highly refractive object lying in the field, or, *vice versâ*, to darken the object in contrast with the field, and so, in a great variety of ways, to render various features conspicuous, and so to vary the character of the image in ways that are very helpful and highly instructive.

He hoped he had not been unfair to this portion of the subject, but the annulus was merely the remaining part after the centre had been stopped out, and he thought there could be no question as to what the effect of this would be. Mr. Conrady seemed very much alarmed lest it should produce intercostal effects, but, of course, the aperture must be adjusted so as not to do this, and, though it was very easy not to get them, it was quite easy to produce them if proper care was not taken.

Mr. Gordon writes to the Editor asking leave to add the following remarks upon a point in Mr. Conrady's criticism which escaped his memory at the moment of replying at the Meeting.

"Mr. Conrady has insisted on the distinction between 'resolution' in the proper sense of that word and the imaging of isolated objects, and states that it has long been known that single objects could be rendered visible, however small, if there is sufficient light available for the purpose. He instances, in illustration of his point, the extreme case of a star seen in a telescope or by the unaided eye. This statement, although perfectly true of bright objects on a dark field, is quite irrelevant to the matter which I have been this evening discussing, that is to say, dark objects on a bright field, and it would not be correct to say that it has long been known that a dark object as small as a star can be seen in the daylight sky; it would not even be true to say that so small an object could be so seen. Thus a telegraph wire projected against a bright cloud becomes invisible at a very moderate distance, and when it

still subtends an angle many, very many times, as great as that subtended by a star. The fact is that in such a case what we really see is the cloud apparently divided into two parts by the wire, which is not itself directly visible. Thus the problem of seeing a telegraph wire against the background of a bright cloud is truly a problem of resolution, for, accurately stated, it must be formulated thus: 'What is the smallest angular distance asunder at which we can see the two parts into which the telegraph wire appears to divide the cloud?' We find, in accordance with this principle, that beyond a certain very feeble degree of illumination, increase of brightness does not increase the visibility of the small dark object. The stem of a weather-cock strongly visible against a bright sky will disappear from view entirely if the disk of the sun comes behind it, and our failure to see it under those conditions is simply a failure to obtain a resolved image of the sun's disk. Interpose a smoked glass in front of your eye and you will see the stem of the weather-cock perfectly outlined against the disk of the sun. The same considerations apply to stained bacteria, or other small dark objects, seen in a bright field, which can be seen only by means of an instrument which yields a well resolved image of the field."

A vote of thanks to Mr. Gordon for his paper, and to those who had taken part in the discussion, was unanimously passed.

Dr. Hebb read a letter which had been received from the Secretary of the Optical Society.

The Chairman reminded the Fellows that at their next Meeting it would be necessary to nominate Officers and Council for the ensuing year, and also to appoint two Auditors of the Society's accounts for the year 1906.

The following Instruments, Objects, etc., were exhibited:—

The Society:—An Old Microscope, by Dollond, presented by Mr. Charles Lees Curties; and an Old Microscope, by Culpeper, presented by Mr. Wynne E. Baxter.

Mr. Conrad Beck:—Optical Bench, for illumination with either ordinary or monochromatic light, arranged to show experimentally that *Amphipleura pellucida* could be resolved by the green light, while it could not be resolved by the yellow light.

Mr. J. W. Gordon:—Specimen of *Staphylococcus* shown with the aid of a top stop, being the original specimen used for the figure that will appear in the Journal in illustration of his paper; Photomicrographs and Lantern Slides shown on the screen in illustration of his paper.

Dr. Hebb:—Doulton's White Porcelain Filter; Small Filter Bottle, for filtering micro-mounting fluids, devised by Mr. H. Taverner.

Mr. J. Rheinberg:—Grayson's Band Plate, and some familiar diatoms shown with $\frac{1}{8}$ in. objective, and No. 6 eye-piece, fitted with Mr. Gordon's Top Stop Apparatus and Opaque Central Stops, to show the triplication of lines and the intercostal markings to which images are liable under those conditions.

New Fellows.—The following were balloted for and elected Fellows of the Society:—Messrs. Cuthbert Otto Ralph Andrews; Charles Anthony, jun.; Charles Arthur Morgan; and Edward O'Brien.

EMENDATION.

Dr. A. C. Stokes writes asking that the words "but not at the posterior extremity, to which it does not fully extend, stopping short of that margin by a considerable interval," should be deleted from his Note (see p. 649, lines 3, 4, 5).

Unfortunately, the request came too late, as the first sheets of the Journal were already printed off.—Ed.

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MEETINGS FOR THE SESSION 1905—1906

AT 8 P.M.

Wednesday,	Oct.	18,	1905	Wednesday,	Feb.	21,	1906
„	Nov.	15,	„	„	Mar.	21,	„
„	Dec.	20,	„	„	Apr.	18,	„
„	Jan.	17,	1906 (*Annual Meeting for Election of Council and Officers.*)	„	May	16,	„
				„	June	20,	„

Fellows intending to exhibit any Instruments or Objects, or to bring forward any Communications at the Ordinary Meetings, will much facilitate the arrangement of the business thereat if they will inform the Secretaries of their intention two clear days at least before the Meeting.

AT THE SAME TEMPERATURE.

Computed from the Coefficient given in the Report of the Standards Commission, 1871-2, by Mr. E. M. Nelson.

μ	in.
1	·000039
2	·000079
3	·000118
4	·000158
5	·000197
6	·000236
7	·000276
8	·000315
9	·000354
10	·000394
11	·000433
12	·000473
13	·000512
14	·000551
15	·000591
16	·000630
17	·000669
18	·000709
19	·000748
20	·000788
21	·000827
22	·000866
23	·000906
24	·000945
25	·000985
26	·001024
27	·001063
28	·001103
29	·001142
30	·001181
31	·001221
32	·001260
33	·001300
34	·001339
35	·001378
36	·001418
37	·001457
38	·001497
39	·001536
40	·001575
41	·001615
42	·001654
43	·001693
44	·001733
45	·001772
46	·001812
47	·001851
48	·001890
49	·001930
50	·001969
60	·002363
70	·002757
80	·003151
90	·003544
100	·003938
200	·007876
300	·011815
400	·015753
500	·019691
600	·023629
700	·027567
800	·031506
900	·035444
	·039382

mm.	in.
1	·039382
2	·078764
3	·118146
4	·157528
5	·196910
6	·236292
7	·275674
8	·315056
9	·354438
10	·393820
11	·433202
12	·472584
13	·511966
14	·551348
15	·590730
16	·630112
17	·669495
18	·708877
19	·748259
20	·787641
21	·827023
22	·866405
23	·905787
24	·945169
25	·984551
26	1·023933
27	1·063315
28	1·102697
29	1·142079
30	1·181461
31	1·220843
32	1·260225
33	1·299607
34	1·338989
35	1·378371
36	1·417753
37	1·457135
38	1·496517
39	1·535899
40	1·575281
41	1·614663
42	1·654045
43	1·693427
44	1·732809
45	1·772191
46	1·811573
47	1·850955
48	1·890337
49	1·929719
50	1·969101
51	2·008484
52	2·047866
53	2·087248
54	2·126630
55	2·166012

mm.	in.
56	2·205394
57	2·244776
58	2·284158
59	2·323540
60	2·362922
61	2·402304
62	2·441686
63	2·481068
64	2·520450
65	2·559832
66	2·599214
67	2·638596
68	2·677978
69	2·717360
70	2·756742
71	2·796124
72	2·835506
73	2·874888
74	2·914270
75	2·953652
76	2·993034
77	3·032416
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84	3·308091
85	3·347473
86	3·386855
87	3·426237
88	3·465619
89	3·505001
90	3·544383
91	3·583765
92	3·623147
93	3·662529
94	3·701911
95	3·741293
96	3·780675
97	3·820057
98	3·859439
99	3·898821

dm.	in.
1	3·938203
2	7·876406
3	11·814609
4	15·752812
5	19·691015
6	23·629218
7	27·567421
8	31·505624
9	35·443827

1 metre = 39·38203 in.
= 3·281836 ft.
= 1·093945 yd.

in.	mm.
1	25·392292
2	50·784584
3	76·176876
4	101·569168
5	126·961460
6	152·353752
7	177·746044
8	203·138336
9	228·530628
10	253·922920
11	279·315212
1 ft.	304·707504
1 yd.	914·122512

in.	mm.
1/2	12·696146
1/3	8·464097
2/3	16·928194
1/4	6·348073
3/4	19·044219
1/5	5·078458
2/5	10·156917
3/5	15·235375
4/5	20·313834
1/6	4·232049
5/6	21·160243
1/7	3·627470
1/8	3·174036
3/8	9·522109
5/8	15·870182
7/8	22·218255
1/9	2·821366
1/10	2·539229
3/10	7·617688
7/10	17·774604
9/10	22·853063
1/11	2·308390
1/12	2·116024
5/12	10·580122
7/12	14·812170
11/12	23·276267
1/13	1·953253
1/14	1·813735
1/15	1·692819
1/16	1·587018
3/16	4·761055
5/16	7·935091
7/16	11·109127
9/16	14·283164
11/16	17·457200
13/16	20·631237
15/16	23·805274
1/17	1·493664
1/18	1·410683
1/19	1·336436

in.	mm.
1/20	1·269615
1/21	1·209157
1/22	1·154195
1/23	1·104013
1/24	1·058012
1/25	1·015692
1/30	·846410
1/35	·725494
1/40	·634807
1/45	·564273
1/50	·507846
1/55	·461678
1/60	·423205
1/65	·390651
1/70	·362747
1/75	·338564
1/80	·317404
1/85	·298733
1/90	·282137
1/95	·267287
1/100	·253923
1/150	·169282
1/200	·126961
1/250	·101569
1/300	·084641
1/350	·072549
1/400	·063481
1/450	·056427
1/500	·050785
1/550	·046168
1/600	·042320
1/650	·039065
1/700	·036275
1/750	·033856
1/800	·031740
1/850	·029873
1/900	·028214
1/950	·026729

in.	μ
1/1000	25·392292
1/2000	12·696146
1/3000	8·464097
1/4000	6·348073
1/5000	5·078458
1/6000	4·232049
1/7000	3·627470
1/8000	3·174036
1/9000	2·821366
1/10000	2·539229
1/15000	1·692819
1/20000	1·269615
1/25000	1·015692